

FLOOD INSURANCE STUDY



VALENCIA COUNTY, NEW MEXICO

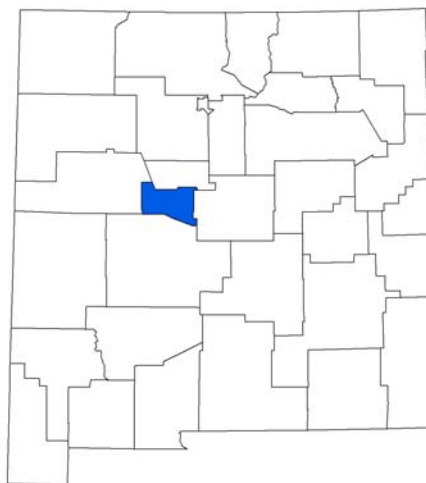
ALL JURISDICTIONS

COMMUNITY NAME

Belen, City of
Bosque Farms, Village of
Isleta, Pueblo of
Laguna, Pueblo of
Los Lunas, Village of
Peralta, Town of
Valencia County
(Unincorporated Areas)

COMMUNITY NUMBER

350088
350142
350057
350003
350144
350040
350086



EFFECTIVE: AUGUST 19, 2010



Federal Emergency Management Agency

Flood Insurance Study Number
35061CV000A

**NOTICE TO
FLOOD INSURANCE STUDY USERS**

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

Selected Flood Insurance Rate Map (FIRM) panels for the community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross-sections). Former flood hazard zone designations have been changed as follows:

<u>Old Zone</u>	<u>New Zone</u>
A1 through A30	AE
B	X
C	X

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current FIS report components.

Effective Date: August 19, 2010

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Flood Insurance Rate Map

**FLOOD INSURANCE STUDY
VALENCIA COUNTY, NEW MEXICO (ALL JURISDICTIONS)**

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Valencia County, New Mexico, including the City of Belen; the Villages of Bosque Farms and Los Lunas; the Town of Peralta; the Isleta and Laguna Pueblos; and the unincorporated areas of Valencia County (referred to collectively herein as Valencia County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the communities in their efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This FIS was prepared to include the unincorporated areas and all jurisdictions within Valencia County in a countywide FIS and Digital Flood Insurance Rate Map (DFIRM) format. The authority and acknowledgments prior to this countywide FIS were compiled from the previously identified FIS reports for flood prone jurisdictions within Valencia County, and are shown below:

Belen, City of:

The hydrologic and hydraulic analyses for the initial study were performed by the U. S. Geological Survey (USGS) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-H-9-77, Project Order Nos. 2 and 7 (9-5-78). This work was completed in May 1979. (Reference 1)

An updated study was performed by Dewberry & Davis under agreement with FEMA to include new

corporate limits. The updated portion was completed in April 1984. (Reference 2)

Bosque Farms, Village of: The hydrologic and hydraulic analyses for the initial study were performed by Bohannon-Huston, Inc., for FEMA, under Contract No. H-6852. This study was completed in July 1981. (Reference 3)

The initial study was revised on February 9, 2000 to incorporate the results of a detailed study of the Rio Grande and Hells Canyon Wash in the vicinity of the Village of Bosque Farms, New Mexico. This detailed study was performed by S. E. Huey Co. (Reference 4)

Los Lunas, Village of: The hydrologic and hydraulic analyses for the initial study were prepared by S. E. Huey Co. for FEMA, under Interagency Agreement No. EMW-90-C-3130. This work was completed in July 1994. (Reference 5)

Valencia County
(Unincorporated Areas): The hydrologic and hydraulic analyses for the initial study were prepared by the USGS for FEMA, under Inter-Agency Agreement No. EMW-87-E2512, Project Order No.2. This work was completed in May 1988. (Reference 6) The initial study was revised on February 9, 2000 to incorporate the results of detailed studies of the Rio Grande and Hells Canyon Wash in the vicinities of the Village of Bosque Farms and Los Lunas, New Mexico. These studies were performed by S. E. Huey Co. (Reference 7)

The authority and acknowledgments for the Town of Peralta, Isleta and Laguna Pueblos are not available because FIS reports were not previously published for these communities.

For this first-time countywide FIS, the enhanced approximate and approximate hydrologic and hydraulic analyses were performed by Mapping Alliance Partners VI (MAPVI), for FEMA, under Contract No. EMT-2002-CO0052, Task Order 43. This work, which was completed in August 2008, covered all significant flooding sources affecting Valencia County. Also during this revision, MAPVI converted the Flood Insurance Rate Map (FIRM) for Valencia County, New Mexico and all jurisdictions to a countywide format.

Base map information shown on the FIRM was derived from multiple sources. Base map files were provided in digital format by the Valencia County Planning Department, the USGS, and the Village of Los Lunas. This information was compiled from orthophotography and field reconnaissance. Additional information was compiled at scales of 1:6,000 and 1:12,000 from aerial photography and the 7.5 minute quadrangles with dates ranging from 1989 to 2006.

The projection used in the preparation of the map was New Mexico State Plane Central Zone (FIPS 3002). The horizontal datum was Geographic Coordinate System National American Datum 1983, with a GRS80 spheroid. Differences in datum, spheroid, projection or State Plane FIPS zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

1.3 Coordination

An initial Consultation Coordination Officer's (CCO) meeting is held with representatives from FEMA, the communities, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied by detailed methods. A final CCO meeting is held with representatives from FEMA, the community, and the study contractor to review the results of the study. All problems raised in the meetings have been addressed in this study.

The dates of the initial and final CCO meetings held for the communities within the boundaries of Valencia County are summarized in Table 1, "Initial and Final CCO Meetings".

Table 1 – Initial and Final CCO Meetings		
Community	Initial CCO Date	Final CCO Date
City of Belen	November 1976	December 9, 1980
Pueblo of Isleta	*	*
Pueblo of Laguna	*	*
Town of Peralta	*	*
Village of Bosque Farms	*	October 27, 1983
Village of Los Lunas	March 17, 1993	April 5, 1995
Unincorporated Areas (Valencia County)	June 11, 1986	August 7, 1990

*Data not available

Detailed information on the CCO meetings held for each jurisdiction included in this countywide FIS, are compiled from their previously printed FIS reports, and are shown below.

City of Belen

In November 1976, the areas requiring detailed study were identified at a meeting attended by representatives of the USGS (the study contractor), FEMA, and the City of Belen. Results of the hydrologic analyses were coordinated with the USACE. On December 9, 1980, the results of the study were reviewed at the final meeting attended by representatives of the study contractor, FEMA, and the city.

Village of Bosque Farms

Areas requiring detailed study were identified in a meeting by representatives of the study contractor, FEMA, and the Village of Bosque Farms. Results of the hydrologic analyses were coordinated with the U.S. Soil Conservation Service (SCS), USGS, and USACE.

On October 27, 1983 the results were reviewed at the final meeting attended by representatives of the study contractor, FEMA, and community officials. The study was acceptable to the community.

Village of Los Lunas

The initial CCO meeting was held on March 17, 1993, and attended by representatives of FEMA, the USGS, Valencia County, the Village of Bosque Farms, the State of New Mexico, and the study contractor.

The results of the study were reviewed at the final CCO meeting held on April 5, 1995, and attended by representatives of FEMA, Valencia County, the Village of Los Lunas and the State of New Mexico. All problems raised at that meeting have been addressed in this study.

Valencia County (Unincorporated Areas)

On June 11, 1986, an initial CCO meeting was held with representatives of FEMA, Valencia County, and the USGS (the study contractor) in order to determine the streams to be studied by detailed methods.

On August 7, 1990, a final CCO meeting was held with representatives of FEMA, Valencia County, and the study contractor in order to review the results of this study.

This Countywide FIS

For this countywide FIS, an initial CCO meeting took place on May 23, 2007. All problems raised in the meeting have been addressed. A final CCO meeting was held on January 22, 2009; and was attended by representatives from FEMA, the communities, and the study contractor to review the results of the study. All problems raised at the meeting have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Valencia County, New Mexico, including the incorporated communities and pueblos listed in Section 1.1. Information on the studies held for each jurisdiction prior to the issuance of this countywide FIS, are compiled from their previously printed FIS reports, and are shown below for reference.

Pre-countywide Analysis

City of Belen

As a result of the initial study, it was determined that the eastern part of the City of Belen was affected by the overflow flooding of the Rio Grande. The main flooding was shallow ponding resulting from alluvial overflow of the arroyos that originated from the Belen Mesa. In the updated study, flood boundaries were added to incorporate changes to the corporate limits. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction. (Reference 7)

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the City of Belen. (Reference 7)

Village of Bosque Farms

Floods caused by overflow from the Rio Grande, which lies west of the village, were studied in detail. The areas studied in detail were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through July 1986. (Reference 3)

The drainage areas east of the village were studied by approximate methods, as they will only affect the undeveloped areas outside the village. The scope and methods of study were proposed to and agreed by FEMA and the Village of Bosque Farms. (Reference 3)

Village of Bosque Farms - February 9, 2000 Revision

As part of the first revision for Valencia County, the Rio Grande and Hells Canyon Wash were studied in detail from a point approximately 4 miles south of the State Route 49 bridge at Los Lunas to a point approximately 5 miles north of this bridge at the north corporate limits of the Village of Bosque Farms. (Reference 4)

Village of Los Lunas

As part of the study of Valencia County, the Rio Grande and Hells Canyon Wash were studied in detail from a point approximately 4 miles south of the State Route 49 bridge at Los Lunas to a point approximately 5 miles north of this bridge at the north corporate limits of the Village of Bosque Farms. Hells Canyon Wash is in the east overbank of the Rio Grande. (Reference 5)

The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction through July 1995. (Reference 5)

Valencia County (Unincorporated Areas)

During the initial study, the following streams were studied by detailed methods: the Rio Grande, from a point approximately 1.9 miles upstream of State Route 49 to a point approximately 4.7 miles upstream of State Route 49; and Hells Canyon Wash, from a point approximately 1.1 miles south of the intersection of State Routes 47 & 236 to a point approximately 1.9 miles north of the intersection of Peralta Boulevard and State Route 47. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through May 1993. (Reference 6)

All or portions of the following flooding sources were studied by approximate methods: the Rio Puerco, Arroyo Comanche, the Rio Grande, Hell Canyon Drain, Cerro Drain, La Canada de la Loma de Arena, Monte Largo Tank, Arroyo Monte Largo, No. 4 Tank, Pedro Draw, Arroyo Monte Belen, Canon Salado, Sabinal Lateral No.1, Sabinal Lateral No.2, Luna Drain, Jaral Ditch, Lower Sabinal Riverside Drain, Arroyo Abo Creek, Garcia Ditch, Bosque Drain, Sabinal Ditch, Jaral Lateral, Feeder Ditch No.3, Belen Highline Canal, Arroyos Ditch, Old Jarales Ditch, Upper Sabinal Riverside, Lower Belen Riverside Drain, New Jarel Ditch, Jaral Lateral No.1, Caldwell Lateral, Lower Peralta Riverside Drain, Old Belen Ditch, Los Chavez Lateral, Sausal Drain, La Constancia Ditch, Guzman Reservoir, Target Reservoir, Tome Ditch, Tome Drain, Jaral Lateral No.2, Canon Arado, and Priest Canyon Creek. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and Valencia County. (Reference 6)

Valencia County - February 9, 2000 Revision

During the first revision, the Rio Grande and Hells Canyon wash were studied in detail from a point approximately 4 miles south of the State Route 49 bridge at Los Lunas to a point approximately 5 miles north of the bridge at the north corporate limits of the Village of Bosque Farms. (Reference 7)

Countywide Analysis

Portions of the Rio Grande were previously studied by detailed methods in the initial FIS for the unincorporated areas and in the communities of the City of Belen and the Village of Bosque Farms.

Those limits of detailed study are listed in Table 2, "Limits of Detailed Study Flooding Sources". Limits of detailed study are listed below and indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

Table 2 – Limits of Detailed Study Flooding Sources

<u>Stream</u>	<u>Limits of Detailed Study</u>
Rio Grande (East Overbank)	From a point approximately 2,000 feet downstream of State Highway 47 to the confluence with Hells Canyon Wash
Rio Grande (East Split Flow)	From confluence with Rio Grande (East Overbank) to a point approximately 7,000 feet upstream of an Unnamed Road.
Rio Grande (Main Channel)	From a point approximately 20,400 feet downstream of Main Street to a point approximately 28,400 feet upstream of Main Street
Rio Grande (West Overbank)	From a point approximately 2,500 feet downstream of the Airport Runway to a point approximately 3,400 feet upstream of the Atchison Topeka and Santa Fe Railroad.
Rio Grande (West Split Flow)	From confluence with Rio Grande (West Overbank) to a point approximately 1,100 feet upstream of confluence with Williams Ditch.

For this revision, the limits of these detailed studies have not been extended; however, the information was redelineated on newer topography.

The areas studied by detailed methods were previously selected with priority given to all known flood hazards and areas of projected development or proposed construction.

During this study, Enhanced Approximate with floodway analyses were used to study those areas having a moderate flooding risk, in areas of future development within the City of Los Lunas. The scope and methods of study were proposed to, and agreed upon, by FEMA and the MAPVI and the City of Los Lunas. For this revision, limits of limited detail studies for the newly studied or revised streams are shown in Table 3, "Scope of Study."

Table 3 - Scope of Study

<u>Stream</u>	<u>Limits of New Enhanced Approximate Study</u>
Rancho Cielo Arroyo 3	From a point just downstream of Interstate 25 to a point approximately 7,900 feet upstream of Interstate 25
Rancho Cielo Arroyo 3 Tributary 1	From the confluence with Rancho Cielo Arroyo 3 to a point approximately 2,260 feet upstream of the confluence with Rancho Cielo Arroyo 3
Rancho Cielo Arroyo 5	From a point just downstream of Interstate 25 to a point approximately 16,700 feet upstream of Interstate 25
Rancho Cielo Arroyo 5, Tributary 1	From the confluence with Rancho Cielo Arroyo 5 to a point approximately 5,370 feet upstream of the confluence with Rancho Cielo Arroyo 5
Rancho Cielo Arroyo 6	From a point just downstream of Interstate 25 to a point approximately 31,900 feet upstream of Interstate 25
Rancho Cielo Arroyo 8	From a point just downstream of Interstate 25 to a point approximately 32,700 feet upstream of Interstate 25
Rancho Cielo Arroyo 9	From a point just downstream of Interstate 25 to a point approximately 14,200 feet upstream of Interstate 25
Rancho Cielo Arroyo 9, Tributary 1	From the confluence with Rancho Cielo Arroyo 9 to a point approximately 6,150 feet upstream of the confluence with Rancho Cielo Arroyo 9

All other flooding sources within the county have been restudied by approximate analyses. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon, by FEMA and MAPVI.

This countywide FIS also incorporates the determination of letters issued by FEMA resulting in map changes as shown in Table 4, “Letters of Map Change.”

Table 4 - Letters of Map Change

<u>Community</u>	<u>Flooding Source(s) and Project Identifier</u>	<u>Case Number</u>	<u>Date Issued</u>	<u>Type</u>
Valencia County (Unincorporated Areas)	Unnamed Arroyo - Ventanta Cove Apartments	06-06-BH28P	07-18-2007	LOMR
City of Los Lunas	Unnamed Arroyo - Ventanta Cove Apartments	06-06-BH28P	07-18-2007	LOMR

2.2 Community Description

Valencia County is located in west-central New Mexico. It is bordered by Bernalillo County to the north, Tarrant County to the east, Socorro County to the south, and Cibola County to the west. Located in Valencia County are the incorporated communities of Belen, Bosque Farms, Los Lunas and Peralta, as well as the jurisdictions of the Laguna and Isleta Pueblos. In 2000, the population of Valencia County was 66,152 (Reference 8). In 2006 the estimated population of Valencia County was 70,389 (Reference 8). Valencia County encompasses a land area of about 1,067 square miles (Reference 8). The climate, which is classified as arid continental, is characterized by fairly hot summers and mild winters, and short, temperate fall and spring seasons. The average annual precipitation is approximately 8 inches. Approximately one half of the precipitation falls from July through September as brief, often intense, thunderstorms. Snowfall is approximately 10 inches in winter, and contributes an average of 2 inches of moisture per year (Reference 9).

City of Belen

The City of Belen is located in Valencia County along the western banks of the Rio Grande, approximately 30 miles south of Albuquerque. The 2000 population estimate of the city was just over 6,900 (Reference 8).

The Rio Grande originates in Colorado and drains an area of 15,291 square miles. All but 1,935 square miles of this area is controlled by dams that are operated primarily as flood control structures. Belen is built in the river valley at an elevation that is in some places equal to or slightly lower than the elevation of the river bed. Belen is at an elevation of approximately 4,800 feet.

A main north-south highway artery, Interstate Highway 25, passes just to the west of Belen. Belen Mesa lies approximately 2.5 miles to the west of the city. There are a number of arroyos that originate on the scarp of the mesa. They flow down the alluvial slope and discharge into the valley where Belen is situated. Channel definition for these arroyos end where they enter the valley; hence, there are no channels to carry flood waters to the river.

The arroyos that emanate from Belen Mesa are dissected by Interstate Highway 25 and by two ditches: Belen Highline Canal and New Belen Acequia. The culverts under the Interstate Highway have the effect of attenuation on the flood peaks. The embankment tends to somewhat reduce the volume by storage and ponding behind it. The two ditches act as dams and impound the water, or pass it into the ditch, or in cases of fairly heavy flood, breach the ditch and pass the flood water and the ditch water into the valley.

Belen is in the Mexican Highlands section of the Basin and Range Physiographic Province and is in a semi-arid climatic zone. The mean annual temperature is approximately 56 degrees Fahrenheit (°F), with a record high of 105°F and a low of -25°F. The diurnal fluctuation of temperatures is high.

Village of Bosque Farms

The Village of Bosque Farms is located approximately 15 miles south of Albuquerque with the Rio Grande flowing north-south along the village's western side. The Village of Bosque Farms was incorporated in August 1974 and had a population of 2,496 (Reference 10). The 2000 Census indicated a population over 3,900 (Reference 8).

Bosque Farms has very little topographic relief. Significant elevation changes are generally a result of development, such as road embankments, irrigation canal levees and building foundations. Valley vegetation consists mainly of native trees and shrubs and irrigated field crops. Land use is mainly small acreage agricultural with low density residential development.

Village of Los Lunas

The Village of Los Lunas was incorporated in 1928 and is located approximately 19 miles south of Albuquerque with the Rio Grande flowing north-south along the village's eastern side. According to the 2000 census, Los Lunas has a population of around 10,000 (Reference 8).

Los Lunas has very little topographic relief. Located in a flat valley between bluffs, Los Lunas is slowly changing from an agricultural valley to a low-density residential community.

2.3 Principal Flood Problems

City of Belen

Flooding in the City of Belen in the recent past has been a result of flood waters from the arroyos emanating from Belen Mesa to the west of the city. In some cases, the flooding has been augmented by water from breached irrigation ditches.

Significant flooding from this local runoff source has occurred in the city during the years 1900, 1919, 1937, 1957, 1961, 1967, and 1969. The floods of May 28, 1937, and June 15, 1969, caused fairly extensive damages through ponding, silting, and erosion. During the 1969 flood, heavy runoff from the arroyos entered the Belen Highline Canal at several points overloading it with flood water and a large amount of silt; consequently, the canal breached at a number of points and storm water, along with an estimated 400-600 cubic feet per second (cfs) of water that was being carried in the canal, swept down across New Belen Acequia and into Belen. Water ponded in Belen at depths of up to 2.5 to 3.0 feet during both the 1937 and the 1969 floods.

The main levee system that protects Belen from Rio Grande flood waters was built during the 1930's. Prior to this time, there were a number of floods on historical record that apparently flooded much of the land in the Rio Grande valley. It should be noted that the levee systems throughout Valencia County are not certified to provide protection from the 1-percent-annual-chance flood according to the requirements of the Code of Federal Regulations at 44 CFR 65.10.

A flood that occurred in May and June of 1828, flooded most of the existing villages along the river and has been estimated to have been as high as 100,000 cfs. Major flooding also occurred during 1851, 1865, 1874, 1884, 1886, 1903, 1911, 1920, 1929, 1935, 1941, and 1942. Most of these floods occurred during the spring and were a result of snowmelt or warm rain on top of an existing snowpack. The floods of 1911, 1929, and 1935 were the result of heavy thunderstorms over the watershed. The 1911 storm occurred in early October and was the result of a large moisture inflow from a tropical Pacific cyclone off the west coast of Mexico.

Although no flooding has occurred in Belen as a result of breaking of the levees along the Rio Grande, this potential does exist. The entire valley would be susceptible to this type of flooding, but the areas that would especially be susceptible would be the agricultural lands near the river to the east of Belen.

Flooding from the Belen Mesa arroyos occurs mainly during the summer months as a result of intense thunderstorms. The problems that arise from this type of flooding are dependent not only on the magnitude of the peaks but also on the

volume of water involved and on the amount of sediment being carried by the floods.

A study of this flooding problem was made by the SCS in 1974. They analyzed volume frequencies and sediment amounts and the effect these phenomena will have on the two ditches: Belen Highline Canal and New Belen Acequia. Breaching of the ditches, mainly Belen Highline Canal, will be dependent on the amount and rate of water and sediment being discharged into a ditch, on the capacity of the canal, and on the amount of irrigation water being carried by the canal at the time of the flood. The canal will breach when the volume of water is greater than the carrying capacity of the canal. That is, runoff from a number of tributaries could enter the canal causing a sustained high volume that would cause breaching; a momentary large discharge from a single tributary could cause breaching; a large buildup of silt could restrict the canal such that a relatively small flow would cause breaching at that point or more likely, breaching would occur as a result of a combination of these factors. The SCS has estimated that breaching of the Belen Highline Canal would occur during events with a 4 percent or less chance of occurrence. There are specific points along the canal where the breaching would most likely occur, but under varying conditions, there are almost any number of places where breaching could occur (Reference 11).

Village of Bosque Farms

Before 1933, the Bosque Farms area was largely swampland covered by trees and dense underbrush. Levees were constructed on either side of the Rio Grande through the Bosque Farms area in 1933 and the swamp was drained by 1935. Shortly thereafter, the area began to be settled. Since the construction of the riverside levees, the Rio Grande has not caused any flooding in the Village of Bosque Farms, however it is important to understand that flooding from a breach in these levees is still a possibility.

It should be noted that the levee systems throughout Valencia County are not certified to provide protection from the 1-percent-annual-chance flood according to the requirements of the Code of Federal Regulations at 44 CFR 65.10.

Village of Los Lunas

Before the 1930s, the Los Lunas area was mainly swampland covered by trees and dense underbrush. In 1933, the Middle Rio Grande Conservancy District constructed channels, drains, and levees along the Rio Grande and surrounding areas to divert the flow, and the area was drained by 1935. Since the construction of the riverside levees, the river has not caused any flooding in Los Lunas, however it is important to understand that flooding from a breach in these levees is still a possibility.

It should be noted that the levee systems throughout Valencia County are not certified to provide protection from the 1-percent-annual-chance flood according to the requirements of the Code of Federal Regulations at 44 CFR 65.10.

Valencia County (Unincorporated Areas)

Before the construction of levees on the Rio Grande, the river caused extensive flooding. Hells Canyon Wash has a drainage area of approximately 165 square miles and has caused minor flooding. Because of the numerous canals and levees, principally the Tome Drain and Chical Ditch, flows from these drainage areas have caused only minor flooding in the undeveloped areas.

The levees that line the Rio Grande have not been built to protect from the 1-percent-annual-chance flood event, however, protect from lesser storms along the river length. It should be noted that the levee systems throughout Valencia County are not certified to provide protection from the 1-percent-annual-chance flood according to the requirements of the Code of Federal Regulations at 44 CFR 65.10.

2.4 Flood Protection Measures

City of Belen

Measures that help protect the City of Belen from Rio Grande flood waters have been in existence, to some degree, since the 1930's when the levee system was built up and down the Rio Grande Valley. Protection further increased as dams were built on the basin above Belen. In 1953, Jemez Canyon Reservoir, with 73,000 acre-feet of flood control storage, gave Belen some protection from approximately 7 percent of the basin. Abiquiu Reservoir, completed on the Rio Chama in 1963, gave an additional 562,000 acre-feet of flood control storage and increased Belen's protection to approximately 21-percent of the basin. The completion of Galisteo Reservoir in 1970 and Cochiti Reservoir in 1975 gave an additional 570,000 acre-feet of storage and increased the protection to approximately 87 percent of the basin above Belen.

The culverts along Interstate Highway 25 to the west of Belen offer a degree of flood protection as some temporary storage will occur when the floods pass through them, causing the peak to be somewhat attenuated.

Of the two ditches that intersect the arroyos, Belen Highline Canal offers some protection from small flows; however, on larger flows, both ditches add to the flooding problem when flood waters breach Belen Highline Canal and the irrigation waters join the flood waters. The resultant flooding in Belen is much larger than might be expected from the floodwaters alone. The New Belen Acequia offers no substantial flood protection. There are several drainage ditches

in or around Belen that were originally designed to drain a high water table. Under conditions of a flood, they do little to alleviate the flooded conditions.

FEMA specifies that, in addition to structural and other requirements, all levees must have a minimum of three feet freeboard against the 1-percent-annual-chance flooding to be considered a safe flood protection structure. The 1-percent-annual-chance flood elevation along the Rio Grande was determined to come within three feet of the top of the levees, therefore the levees have not been shown to protect against the 1-percent-annual-chance flood. The 0.2-percent-annual-chance flood will breach the levees at a number of points. The areas protected by the levee were thus analyzed and mapped as if the levees were not there in order to show the potential hazard from a 1-percent-annual-chance flood event.

Village of Bosque Farms

Historically, floodwater from drainage areas east of Bosque Farms have caused localized shallow flooding on the land east and north of the village. In part, the numerous irrigation canals prevent these floods from reaching the Village of Bosque Farms. In addition to this, the Bureau of Indian Affairs (BIA) has constructed five retention dams along Hell's Canyon Wash, the only arroyo of any significant size east of the village (Reference 13).

Non-structural measures of flood protection are being utilized to aid in the prevention of future flood damage. These are in the form of land use regulations adopted from the NFIP which control building within areas that have a high risk of flooding (Reference 14).

Village of Los Lunas

Levee construction along the Rio Grande, along with several dams and reservoirs upstream of the study area, has lessened damage caused by flooding of the river. The Rio Grande Levees from Isleta to Belen, New Mexico, provide protection against floods up to 7,500 cfs, which is approximately a 5-percent-annual-chance flood event (Reference 1). The 1-percent-annual-chance flood in this reach varies from 12,800 cfs at Belen (Reference 15) to 14,800 cfs at the Village of Bosque Farms (Reference 6). The flows determined at Bosque Farms are no longer valid and have been replaced with a discharge of 18,400 cfs.

In addition, the Bureau of Indian Affairs has constructed five retention dams along Hells Canyon Wash, the only arroyo of any significant size east of the village (Reference 13).

Valencia County (Unincorporated Areas)

Levee construction along the Rio Grande, along with several dams and reservoirs, has lessened the damages caused by flooding of the river. The flood control storage of these dams and reservoirs are as follows: Cochiti Dam - 486,000 acre-feet; Abiquiu Dam - 502,000 acre-feet; Galisteo Dam - 79,600 acre-feet; and

Jemez Canyon Dam - 73,000 acre-feet. Platoro Dam has 6,000 acre-feet of storage allocated for flood control and an additional 50,000 acre-feet combined storage. El Vado Dam has 196,500 acre-feet of storage for irrigation (Reference 12).

Other levees exist in the study area which provides the community with some degree of protection against flooding. However, it has been ascertained that these levees may not protect the community from rare events such as the 1-percent-annual-chance flood. The criteria used to evaluate protection against the 1-percent-annual-chance flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. Levees that do not protect against the 1-percent-annual-chance flood are not considered in the hydraulic analysis of the 1-percent-annual-chance floodplain.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this FIS. Flood events of a magnitude, which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent-chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1-year are considered. For example, the risk of having a flood, which equals or exceeds the 100-year flood (1-percent-chance of annual exceedance) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this FIS. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the county.

Pre-countywide Analysis

Each community within Valencia County, with the exception of the Town of Peralta, Isleta and Laguna Pueblos, has a previously printed FIS report narrative. The hydrologic analyses described in those narratives have been compiled and are summarized below.

City of Belen

Past flooding in the Rio Grande has occurred mainly as a result of snowmelt or rain and snowmelt. Since these types of floods should be controlled by Cochiti and other reservoirs, the analysis of flood frequency was aimed at those floods that could occur as a result of heavy rainfall over the unregulated area (1,935 square miles) between Belen and the flood control dams. The dams in the system are considered to be completely controlling of any floods that originate above the structures. No attempt was made to estimate the frequency of failure of any of these structures.

Existing study of the flood-frequency characteristics for the unregulated area was made by the USACE which produced flood magnitudes that were within 5-percent to 95-percent confidence limits of magnitudes estimated using the USGS regional equations (Reference 16); therefore, the magnitudes presented in the initial study by the USACE were accepted as the basis for this study (Reference 17).

Village of Bosque Farms

Additional hydrologic analyses considered the impact of the North and South Diversion Channels, which empty into the Rio Grande and drain much of Northeast and Southeast Albuquerque. Results indicate, for any recurrence interval flood, the discharges of the North Diversion Channel and the South Diversion Channel into the Rio Grande are slightly less than the discharge from the unregulated drainage area upstream of Bernalillo. The flood flows from the diversion channels will attenuate more rapidly compared to flood flows from the drainages upstream of Bernalillo and therefore will impact Bosque Farms less than the flood flows originating upstream of Bernalillo.

Valencia County (Unincorporated Areas)/Village of Los Lunas

Regional equations developed for estimating peak flows for the 1-percent-annual-chance flood on unregulated streams were used to define the 1-percent-annual-chance flood for Hells Canyon Wash (Reference 22). The characteristics used to compute the 1-percent-annual-chance flood discharge for Hells Canyon Wash are drainage area, average channel elevation, and maximum 24-hour precipitation intensity for a 10-percent-annual-chance recurrence interval. The discharges from seven tributary inflows were proportioned equally throughout the portion studied.

For the Rio Grande, the hydrologic analyses were taken from the Flood Insurance Study for the Village of Bosque Farms (Reference 3). In that study, a USACE flood-frequency study of the unregulated drainage area between Cochiti Dam and Bernalillo was used (Reference 1). The study indicates that flows originating upstream of Cochiti (which has been in operation since April 1975) are controlled by the dams within the Rio Grande system up to the 1-percent-annual-chance flood. To determine flows originating from areas downstream of Cochiti, flow

records at Bernalillo were modified to separate out portions of flows that are now regulated. The remaining synthetic peak flow record was then analyzed by the log-Pearson III procedure and adjusted for expected probability (Reference 18). The USGS also analyzed the synthetic record as part of the FIS for the City of Belen. The log-Pearson III procedure was used, but based on FEMA guidelines, peak flows were not adjusted for expected probability. Both agencies attenuated peak flows by the modified Puls routing method used in HEC-1 (Reference 20). The discharge frequency relation developed by the USGS was used in this study.

The USACE based their study on a series of peak flows at Rio Grande near Bernalillo from 1941 to 1969. The flows as recorded at that station were then modified to separate out what should be the portion of these flows that came from the now regulated portion of the basin. The resultant synthetic series of peak flows were then analyzed by the log-Pearson Type III method using Water Resources Council Bulletin 15 guidelines. The USACE adjusted the flow magnitudes for expected probability and routed selected flows down to Belen using the modified Puls method of HEC-1.

A second flood-frequency curve was developed based on 20 years (1974 to 1993) of releases from Cochiti and Jemez Reservoirs. The annual peak flows resulting from reservoir releases generally occur in the spring as a result of snowmelt runoff. The uncontrolled annual peak flows generally occur at different times of the year, the two frequency curves were combined by adding the exceedance probabilities for a given peak flow. The resulting base flood discharge was then routed downstream to arrive at a discharge of 18,400 cfs in Valencia County. For Hells Canyon Wash, the discharges were developed using Snyder's synthetic coefficients found in the USACE study entitled "Middle Rio Grande Flood Protection, Bernalillo to Belen, New Mexico, General Design Memorandum, Volume I, Main Report," dated April 1986 (Reference 21). These coefficients were used with the USACE HEC-1 computer program (Reference 20) to develop peak flows.

February 9, 2000 Revision

The first revision to the Valencia County (Unincorporated Areas) FIS was the incorporation of an updated hydrologic and hydraulic study of the Rio Grande performed by the USACE – Albuquerque District. This revision also updated the Village of Los Lunas FIS. The Rio Grande levees along the reach between Isleta and Belen, New Mexico, which includes the Village of Bosque Farms, provide protection against floods up to 7,500 cfs, which is approximately a 26-year flood (Reference 1). The 1-percent-annual-chance flood in this reach of the Rio Grande Main Channel varies from 12,800 cfs at Belen (Reference 15) to 14,800 cfs at Bosque Farms (Reference 3). The flows generated in this revision were calculated separately for the main channel of the Rio Grande and the east and west overbanks of the Rio Grande. The flow for the detailed study reaches within the Valencia County have been computed to be 18,400 cfs.

Discharges for the Rio Grande were computed by the USACE, Albuquerque District. As part of the design and planning study for improved levees along the Rio Grande, the USACE updated the flood frequency analysis for the Rio Grande at several locations from Bernalillo to Belen. The USACE developed a combined frequency curve that reflects the probability of flooding from reservoir releases (Cochiti and Jemez Reservoirs) and from the uncontrolled inflow from areas between existing dams and the City of Albuquerque. For the new analysis, the USACE used the adjusted peak flow data for the period 1941 to 1969 plus an additional 20 years of adjusted peak flow data (from 1974 to 1993) to develop a flood-frequency curve reflecting the potential flooding from uncontrolled runoff downstream of the existing reservoirs. A second flood-frequency curve was developed based on 20 years (1974 to 1993) of releases from Cochiti and Jemez Reservoirs. The annual peak flows resulting from reservoir releases generally occur in the spring as a result of snowmelt runoff. The uncontrolled annual peak flows generally occur in the summer due to runoff from thunderstorms. Since these two types of floods generally occur at different times of the year, the two frequency curves were combined by adding the exceedance probabilities for a given peak flow. The resulting 1-percent-annual-chance flood discharge was then routed downstream to arrive at a discharge of 18,400 cfs in Valencia County.

For Hells Canyon Wash, the discharges were developed using Snyder's synthetic coefficients found in the USACE study entitled "Middle Rio Grande Flood Protection, Bernalillo to Belen, New Mexico, General Design Memorandum, Volume I, Main Report," dated April 1986 (Reference 21). These coefficients were used with the USACE HEC-1 computer program (Reference 20) to develop peak flows. The revised floodplain boundaries and base (1-percent-annual-chance) flood elevations (BFEs) were developed using the USACE HEC-2 computer program (Reference 23). Starting water-surface elevations were obtained using the slope-area method.

Countywide Analysis

New Mexico regional regression equations developed for estimating peak flows for the 1-percent-annual-chance flood on unregulated streams were used to calculate the 1-percent-annual-chance flood flow for approximate study streams, with input parameters inside the recommended range, restudied in Valencia County (Reference 25). The characteristics used to compute the 1-percent-annual-chance flood discharge for approximate study streams are drainage area, average channel elevation, and maximum 24-hour precipitation intensity for a 10-percent-annual-chance recurrence interval.

For all enhanced approximate and approximate study streams that were assigned input parameters outside the recommended range for the New Mexico regional regression equations, discharges for the 1-percent-annual-chance recurrence interval were determined using the USGS regression equations from the USGS Water Supply Paper 2433 for the Methods for Estimating Magnitude & Frequency of Floods in the Southwestern United States (Reference 26).

Peak discharge-drainage area relationships for streams studied in detail for all communities within Valencia County are shown in Table 5, “Summary of Discharges”.

Table 5 - Summary of Discharges

Detailed Study Streams					
FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10% Annual <u>Chance</u>	2% Annual <u>Chance</u>	1% Annual <u>Chance</u>	0.2% Annual <u>Chance</u>
Rio Grande at upstream corporate limits of Bosque Farms	18,100	*	*	18,400	*
Enhanced Approximate Streams					
FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10% Annual <u>Chance</u>	2% Annual <u>Chance</u>	1% Annual <u>Chance</u>	0.2% Annual <u>Chance</u>
Rancho Cielo Arroyo 3	3.66	*	*	3,140	*
Rancho Cielo Arroyo 3, Tributary 1	1.09	*	*	1,710	*
Rancho Cielo Arroyo 5	2.59	*	*	2,640	*
Rancho Cielo Arroyo 5, Tributary 1	0.82	*	*	1,490	*
Rancho Cielo Arroyo 6	6.05	*	*	4,030	*
Rancho Cielo Arroyo 8	6.19	*	*	4,080	*
Rancho Cielo Arroyo 9	2.68	*	*	2,680	*
Rancho Cielo Arroyo 9, Tributary 1	0.88	*	*	1,540	*

*Data not available

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Locations of selected cross-sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the FIRM (Exhibit 2) where applicable.

Pre-countywide Analysis

Each community within Valencia County, with the exception of the Town of Peralta, Isleta and Laguna Pueblos, has a previously printed FIS report narrative. The hydraulic analyses described in those narratives have been compiled and are summarized below.

In the April 3, 1985 City of Belen FIS, cross-sections for the backwater analyses of the Rio Grande were obtained by photogrammetric methods from maps prepared from aerial photographs flown in February 1977 at a scale of 1" = 400'. All bridges were field surveyed to obtain elevation data and structural geometry.

Channel roughness factors (Manning's "n") used in the hydraulic computations were estimated using field inspections of the river and its floodplain and engineering judgment. Roughness values for the Rio Grande main channel range from 0.030 to 0.060. Values in the floodplain ranged from 0.060 to 0.150. The upper roughness values for the floodplain areas were used where dense forests and numerous leveed irrigation or drainage ditches produced situations where flooding with negligible velocities could occur.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the USGS computer program E431 for step-backwater analyses. Starting water-surface elevations were calculated using the slope/area method.

A USGS gaging station was operated for 14 years (1942 to 1956) at the bridge where State Highway 6 crosses the Rio Grande. The ratings that were developed and used at the gaging station were compared with a stage-discharge relationship developed at that bridge using the profiles computed by step-backwater analyses. The step-backwater rating is approximately 1.5 feet higher than the highest rating used during the period of station operations. This difference is not unreasonable in light of changing channel conditions in this reach. During the period of gage operation, discharges would vary by as much as 100 percent of the same gage

height. The bed of the Rio Grande has been filling since levees were first built in 1942, and the channel bed is now higher than it was 37 years ago.

In the February 9, 2000 revision to the Village of Bosque Farms, the Village of Los Lunas, and Valencia County (Unincorporated Areas) FIS's, the Rio Grande underwent a hydrologic and hydraulic study. Cross-sections for the Rio Grande were taken from HEC-2 computer runs prepared by the USACE, Albuquerque District, for a study of the Middle Rio Grande levees (Reference 21). These cross-sections were extended in the east overbank using aerial photographs at a scale of 1:4,800, prepared for the USACE, Albuquerque District. The cross-sections were extended in the west overbank using aerial photographs at a scale of 1:16,000, with 4-foot contour intervals, outside the river levees (Reference 27). Elevations and structural geometry for the State Route 49 bridge over the Rio Grande remained the same for this revision, as did the Manning's roughness coefficients (Manning's "n" values). The profile stationing for the east and west overbanks of the Rio Grande is based on the profile baseline for each overbank as shown on the FIRM.

The ground elevations in the main channel of the Rio Grande are higher than the ground elevations in the east overbank. Revised BFEs were developed for the east overbank of the Rio Grande, affecting the communities of Los Lunas, Bosque Farms, and Valencia County, by determining the minimum capacity of the main channel upstream of Los Lunas (500 cfs) and assuming the remaining flow was in the east overbank.

The east overbank of the Rio Grande can be flooded by Hells Canyon Wash as well as the Rio Grande. The 1-percent-annual-chance water-surface elevations were computed for the east overbank for two cases: (1) flooding due to failure of the east levee of the Rio Grande with no discharge contribution from Hells Canyon Wash; and (2) flooding from Hells Canyon Wash with the Rio Grande levees intact. Case 1 results in higher water-surface elevations along the east overbank of the Rio Grande. Therefore, the water-surface elevations resulting from the Rio Grande discharge control the flooding in the east overbank and the water-surface elevations resulting from the Hells Canyon Wash discharge are not shown on the FIRM. In addition, the hydraulic modeling indicates that floodwaters are diverted around both sides of high ground along the east overbank of the Rio Grande in Bosque Farms. This split flow method indicated higher water-surface elevations on the East Split Flow profile baseline than on the West Split Flow profile baseline. The split flow water-surface elevations are shown on the FIRM and on the profiles for the East and West Split Flows of the Rio Grande through Valencia County.

Countywide Analyses

Cross-section geometries were obtained from a combination of digital terrain data provided by the USGS and field surveys. For enhanced approximate study streams, all bridges, dams, and culverts were field surveyed to obtain invert

elevation data and all structure openings. Selected cross-sections were field surveyed along the streams to determine channel geometries between bridges and culverts.

Manning's n-values used in hydraulic computations were field investigated and delineated on USGS Digital Orthophoto Quarter Quads (DOQQ) for both channel and overbank areas. Table 6, "Manning's "n" Values," provides a listing of roughness coefficients used in the models.

Table 6 - Manning's "n" Values

Detail Study Streams

<u>Flooding Source</u>	<u>Channel "n"</u>	<u>Overbank "n"</u>
Rio Grande	0.020 to 0.025	0.060 to 0.090

Enhanced Approximate Study Streams

<u>Flooding Source</u>	<u>Channel "n"</u>	<u>Overbank "n"</u>
Rancho Cielo Arroyo 3	0.045	0.045 to 0.050
Rancho Cielo Arroyo 3, Tributary 1	0.045	0.050
Rancho Cielo Arroyo 5	0.035	0.050
Rancho Cielo Arroyo 5, Tributary 1	0.035	0.050
Rancho Cielo Arroyo 6	0.035	0.050
Rancho Cielo Arroyo 8	0.035	0.045 to 0.050
Rancho Cielo Arroyo 9	0.035	0.045
Rancho Cielo Arroyo 9, Tributary 1	0.035	0.045

Starting conditions for the hydraulic models were set to normal depth using a starting slope calculated from values taken from topographic data (Reference 33) or, where applicable, derived from the water surface elevations of existing effective flood elevations. Water-surface profiles were computed through the use of the USACE HEC-RAS version 3.1.3 water-surface profiles computer program (Reference 24). The model was run for the 1-percent-annual-chance storm for the detail and enhanced approximate studies.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Locations of selected cross-sections used in the detailed hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 2).

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD 1988. Structure and ground elevations in the county must, therefore, be referenced to NAVD 1988. It is important to note that adjacent counties with older effective dates may be referenced to NGVD 1929. This may result in differences in base flood elevations (BFEs) across the county boundaries between the counties.

Prior versions of the FIS report and FIRM were referenced to NGVD 29. When datum conversion is effected for a FIS report and FIRM, the flood profiles, BFEs, reflect the new datum values. To compare structure and ground elevations to 1-percent-annual-chance (100-year) flood elevations shown in the FIS and on the FIRM, the subject structure and ground elevations must be referenced to the new datum values.

In the February 2000 revision, both the Village of Bosque Farms and Valencia County (Unincorporated Areas) converted their elevations from NGVD 29 to NAVD 88. Therefore no datum conversions were applied during this countywide study.

The Base Flood Elevations shown on the FIRM represent whole-foot rounded values. For example, a Base Flood Elevation of 102.4 will appear as 102 on the FIRM and 102.6 will appear as 103. The elevations shown on the Flood Profiles and supporting data tables in the FIS report can be determined to the nearest 0.1 foot.

For more information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey, SSMC-3, #9202
1315 East-West Highway

Silver Spring, Maryland 20910-3282
(310) 713-3191

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook (TSDN) associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages state and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 1-percent annual chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1-percent and 0.2-percent-annual-chance floodplains; and 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, and Floodway Data tables. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance (500-year) flood is employed to indicate additional areas of flood risk in the county. For the streams studied in detail, the 1-percent and 0.2-percent-annual-chance floodplains have been delineated using the flood elevations determined at each cross section. Between cross-sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800, 1:16,000, and 1:24,000, with contour intervals of 2, 4, 10, and 20 feet (References 27, 29, and 31).

The boundaries of the 1-percent and 0.2-percent-annual-chance floods are shown on the FIRM (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, and AO), and the 0.2-percent-annual-chance floodplain boundary corresponds to the areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within

the floodplain boundaries may lie above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

During the first revision for the Village of Bosque Farms and Valencia County (Unincorporated Areas), cross-sections were extended in the east overbank using aerial photographs at a scale of 1:4,800, prepared for the USACE, Albuquerque District. The cross-sections were extended in the west overbank using aerial photographs at a scale of 1:16,000, with 4-foot contour intervals, outside the river levees (Reference 27).

An approximate 1-percent-annual-chance floodplain boundary was delineated below the limit of detailed study for the Rio Grande, tying into an existing approximate 1-percent-annual-chance boundary north of Belen. This Zone A boundary is the flood insurance rate zone that corresponds to the 1-percent annual chance floodplains that are determined by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or depths are shown within this zone.

For this countywide FIS the Rio Grande detailed analysis previously performed were redelineated using USGS 10-meter DEMs (Reference 28).

For the streams studied by approximate methods, only the 1-percent annual chance floodplain boundary is shown on the FIRM. Existing approximate analysis was refined using the DEMs discussed previously.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this FIS are presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

No floodways were computed for flooding sources studied by detailed methods in Valencia County.

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplains will not cause more than a 1.0-foot increase in the BFEs at any point within the county.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent-annual-chance flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1, "Floodway Schematic."

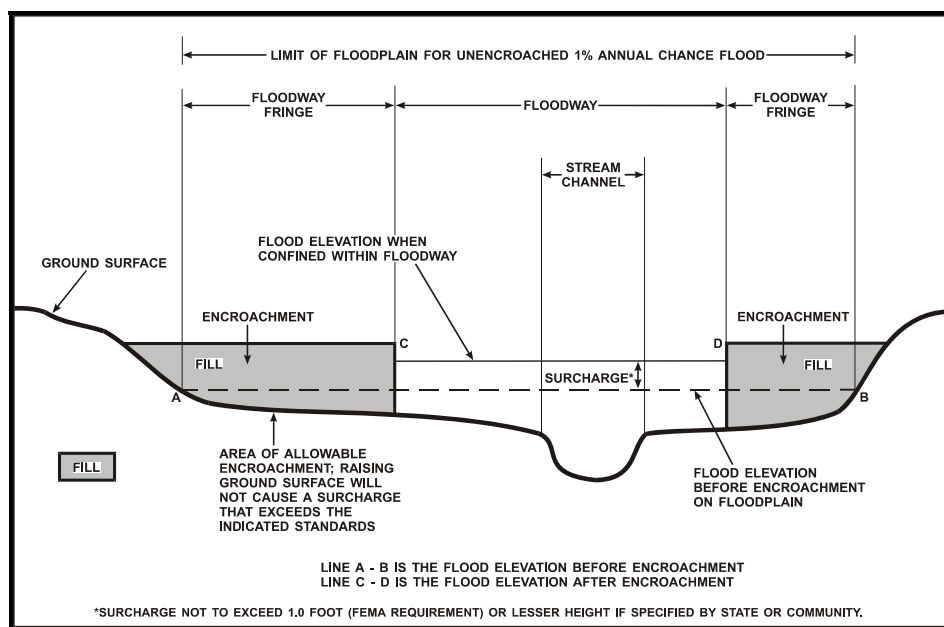


Figure 1 – Floodway Schematic

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent annual-chance floodplains that are determined in the FIS by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 2-percent annual-chance floodplain, areas within the 2-percent-annual-chance floodplain, and areas of 1-percent-annual-chance flooding where average depths are less than 1-foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and shows selected whole-foot BFEs or average depths in the 1-percent-annual-chance floodplains that were studied by detailed methods. Insurance agents use the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map uses tints, screens, and symbols to show the 1-percent and 0.2-percent-annual-chance floodplains. Floodways and the locations of selected cross-sections used in the hydraulic analyses and floodway computations are shown where applicable.

The current FIRM presents flooding information for the entire geographic area of Valencia County. Previously, separate FIRMs were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. This countywide FIRM also includes flood hazard information that was presented separately on FBFM's, where applicable. Historical data relating to the maps prepared for each community, up to and including this countywide FIS are presented in Table 7 - Community Map History

7.0 OTHER STUDIES

This FIS report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

City of Belen

The SCS completed a Watershed Work Plan for flood protection and flood prevention in the Belen-Los Lunas watershed in 1974. The work plan examined the flooding that emanates from the mesas west of these communities. The work plan presented a summary of the hydrologic investigations and incorporated structural designs for proposed flood control measures. The hydrologic investigations into the flooding from Belen Mesa were considered basically acceptable for the purpose of that study (Reference 15).

The Albuquerque District of the USACE evaluated flood potential, existing flood protection measures, and the best alternatives for increasing the flood protection. They published a draft of a proposed interim feasibility report, Middle Rio Grande Flood Protection, Bernalillo to Belen, New Mexico, in February 1979 (Reference 17).

Village of Bosque Farms

Studies used as reference in this study are references 12, 21, and 33. The discharges used in this study for the Rio Grande are consistent with those used in the City of Belen FIS, in accordance with FEMA Guidelines and Specifications for Contractors – FEMA 37 (Reference 19) at the time of the initial effective issuance. Flow regulation information came from the Cochiti Lake Water Control Manual (Reference 12).

Bernalillo County

MAPVI recently prepared the countywide FIS for Bernalillo County, New Mexico. The analysis prepared in Valencia County has been reviewed against the findings of the Bernalillo County study and the methodologies have found to be consistent. Flooding at the county boundary to the north have been tied into the Bernalillo County analysis.

COMMUNITY NAME		INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE (S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE (S)
Belen, City of		June 7, 1974	April 2, 1976	September 16, 1982	April 3, 1985
Bosque Farms, Village of		October 27, 1983	None	February 15, 1985	February 9, 2000
Isleta, Pueblo of		August 19, 2010	None	August 19, 2010	None
Laguna, Pueblo of		March 18, 2008 (Sandoval County)	None	March 18, 2008 (Sandoval County)	None
Los Lunas, Village of		April 6, 2000	None	April 6, 2000	None
Peralta, Town of		August 19, 2010	None	August 19, 2010	None
Valencia County (Unincorporated Areas)		May 30, 1978	June 15, 1984	July 2, 1991	February 9, 2000
TABLE 8	FEDERAL EMERGENCY MANAGEMENT AGENCY VALENCIA COUNTY, NM ALL JURISDICTIONS			COMMUNITY MAP HISTORY	

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this FIS can be obtained by contacting:

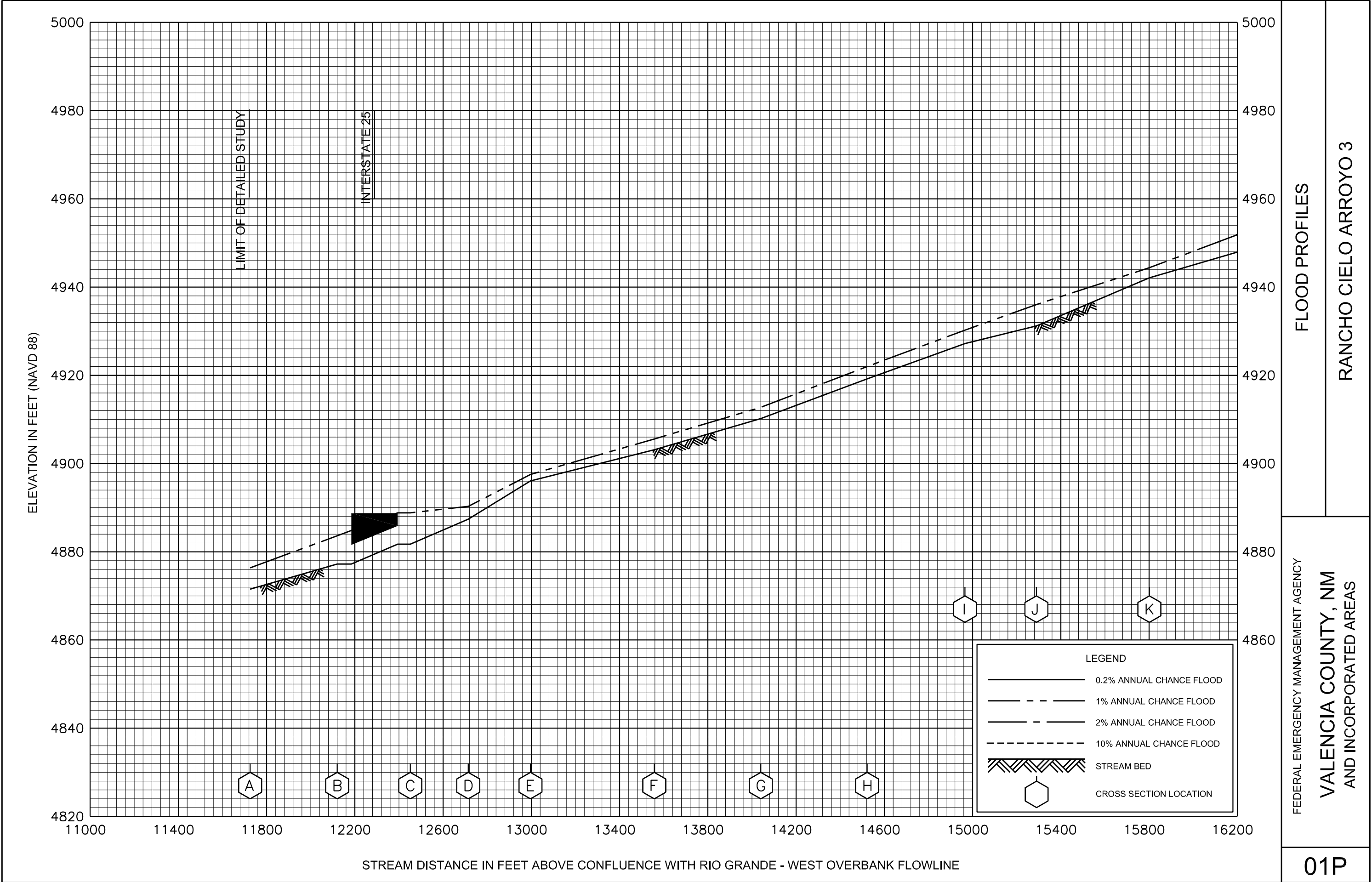
FEMA Region VI,
Federal Insurance and Mitigation Division,
800 North Loop 288,
Denton, Texas 76209

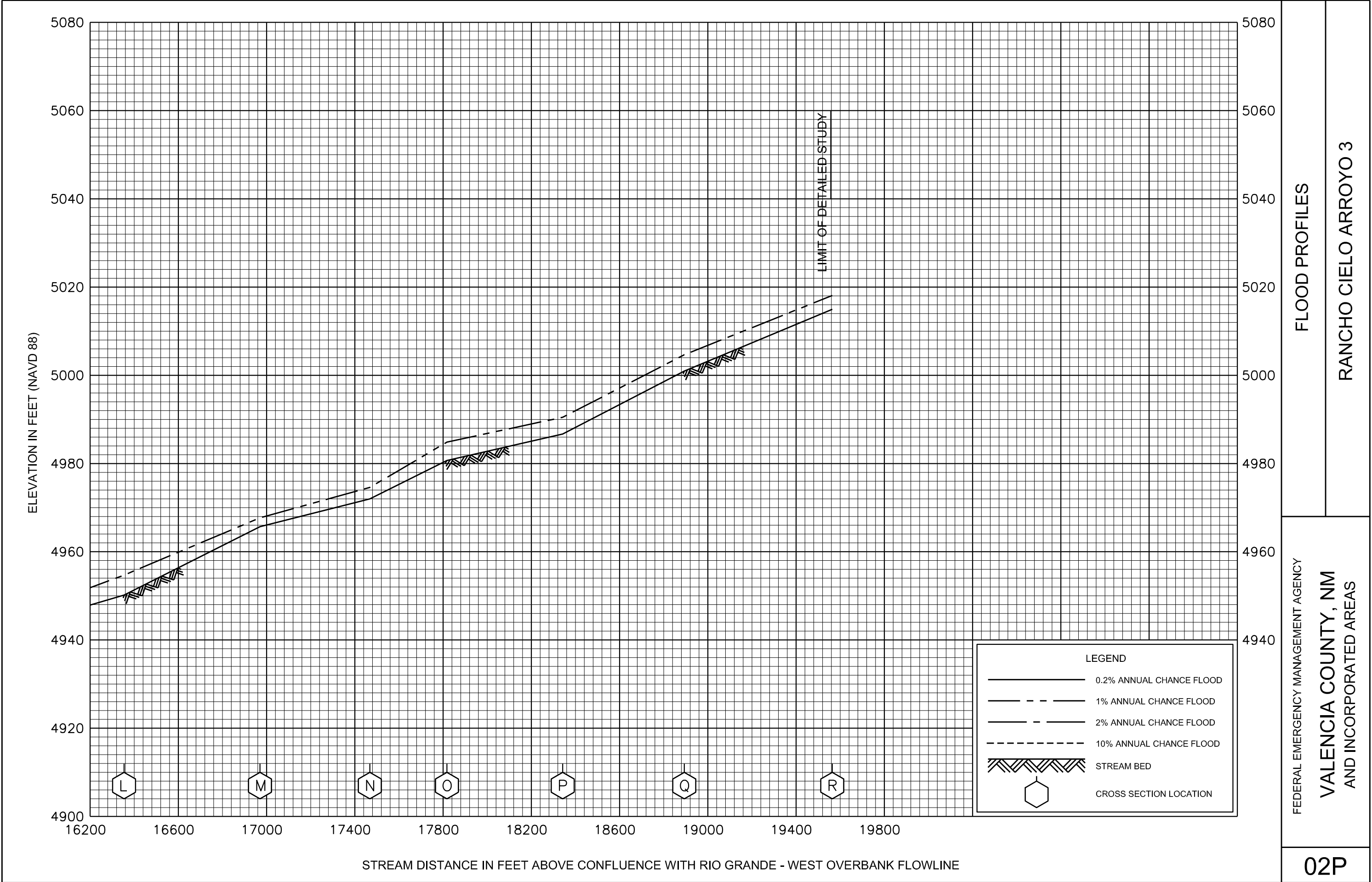
9.0 BIBLIOGRAPHY AND REFERENCES

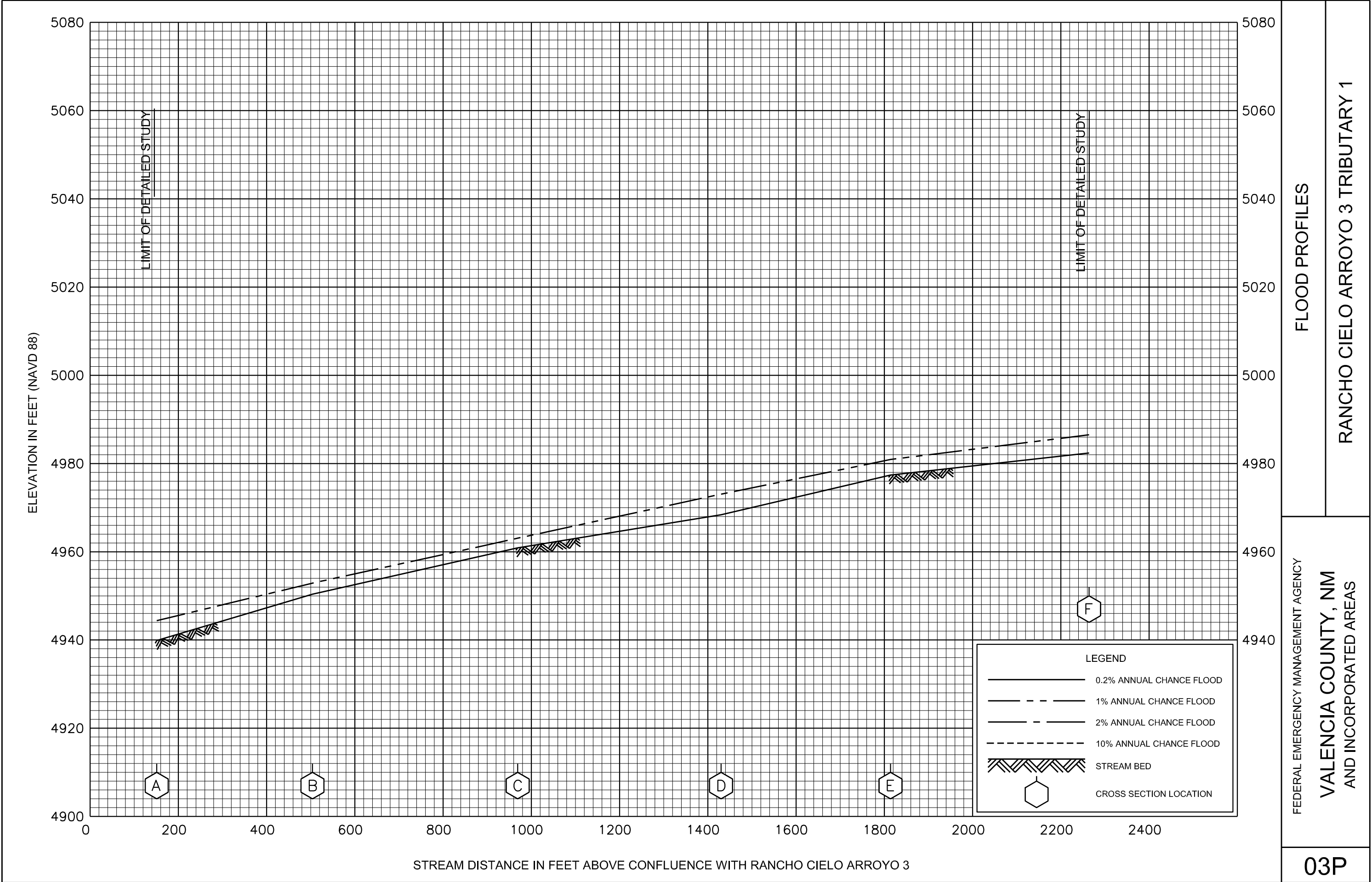
1. U.S. Army Corps of Engineers, Albuquerque District, Middle Rio Grande Flood Protection, Bernalillo to Belen, New Mexico, Interim Feasibility Report, Volume III, Appendices D, E, and F, May 1979.
2. Federal Emergency Management Agency, Flood Insurance Study, City of Belen, Valencia County, New Mexico, Washington, D.C., April 3, 1985.
3. Federal Emergency Management Agency, Flood Insurance Study, Village of Bosque Farms, Valencia County, New Mexico, Washington, D. C., August 15, 1984 (Flood Insurance Rate Map dated February 15, 1985).
4. Federal Emergency Management Agency, Flood Insurance Study, Village of Bosque Farms, New Mexico, Washington, D.C., February 9, 2000.
5. Federal Emergency Management Agency, Flood Insurance Study, Village of Los Lunas, New Mexico, Washington, D.C., April 6, 2000.
6. Federal Emergency Management Agency, Flood Insurance Study, Valencia County, New Mexico, Washington, D.C., July 2, 1991.
7. Federal Emergency Management Agency, Flood Insurance Study, Valencia County Unincorporated Areas, New Mexico, Washington, D.C., February 9, 2000.
8. U.S. Census Bureau, State & County Quick Facts,
<http://quickfacts.census.gov/qfd/states/35/35061.html>, accessed January 30, 2008.
9. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Climates of the United States, Silver Spring, Maryland, December 1959, revised 1972.
10. Verbal Communication, Mayor Sharon Eastman, Village of Bosque Farms, New Mexico, July 28, 1981.
11. U. S. Department of Agriculture, Soil Conservation Service, papers relating to floods in the Belen-Los Lunas area, 1964-1974 (Unpublished).
12. U.S. Army Corps of Engineers, Albuquerque District, Cochiti Lake, Rio Grande Basin, New Mexico, Water Control Manual, July 1978.

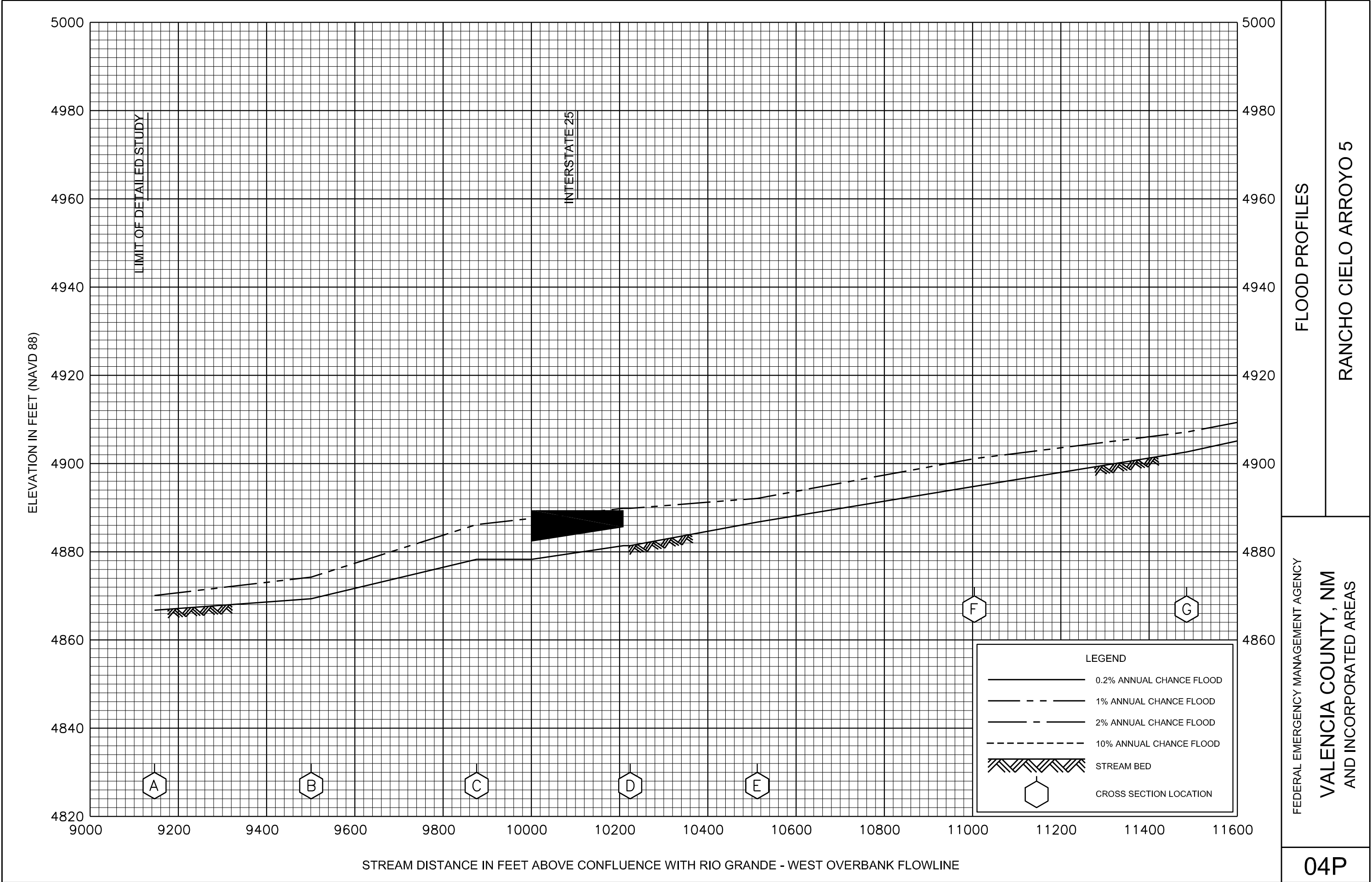
13. Bureau of Indian Affairs, National Resources Division, Verbal Communication, Bob McCormack, Albuquerque, New Mexico, July 28, 1981.
14. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Code of Federal Regulations, Title 24, Chapter 10, Parts 1910, 3A and 3B, Federal Register, Vol. 41, No. 207, Revision 1976.
15. Federal Emergency Management Agency, Flood Insurance Study, City of Belen, Valencia County, New Mexico, Washington, D.C., March 16, 1982.
16. U.S. Department of the Interior, Geological Survey, Open-File Report 76-499, Computer Applications for Step-Backwater and Floodway Analysis by James O. Shearman, Washington, D. C., 1976.
17. U.S. Army Corps of Engineers, Albuquerque District, Middle Rio Grande Flood Protection, Bernalillo to Belen, New Mexico, a draft of a proposed interim feasibility report, Albuquerque, New Mexico, February 1979.
18. U.S. Water Resources Council, Guidelines for Determining Flood Flow Frequency, Bulletin No. 17A, Hydrology Committee, June 1977.
19. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Guidelines and Specifications for Study Contractors, Washington D.C., October 1977, Revised 1979.
20. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, Generalized Computer Program, Davis, California, Revised September 1990.
21. U.S. Army Corps of Engineers, Albuquerque District, Middle Rio Grande Flood Protection, Bernalillo to Belen, New Mexico, General Design Memorandum, Volume I, Main Report, April 1986.
22. U. S. Department of the Interior, Geological Survey, Water Resources Investigations Report 86-4104, Techniques for Estimating Flood-Flow Frequency for Unregulated Streams in New Mexico, by S. D. Waltemeyer, 1986.
23. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, February 1991.
24. U.S. Army Corps of Engineers (USACE). U.S. Army Corps of Engineers River Analysis System (HEC-RAS) User's Manual and software version 3.1.3. Hydrologic Engineering Center. Davis, CA. May 2005.
25. US Geological Survey. Fact Sheet 055-00, Methods for Estimating Magnitude & Frequency in Rural Areas of New Mexico. October 2000.

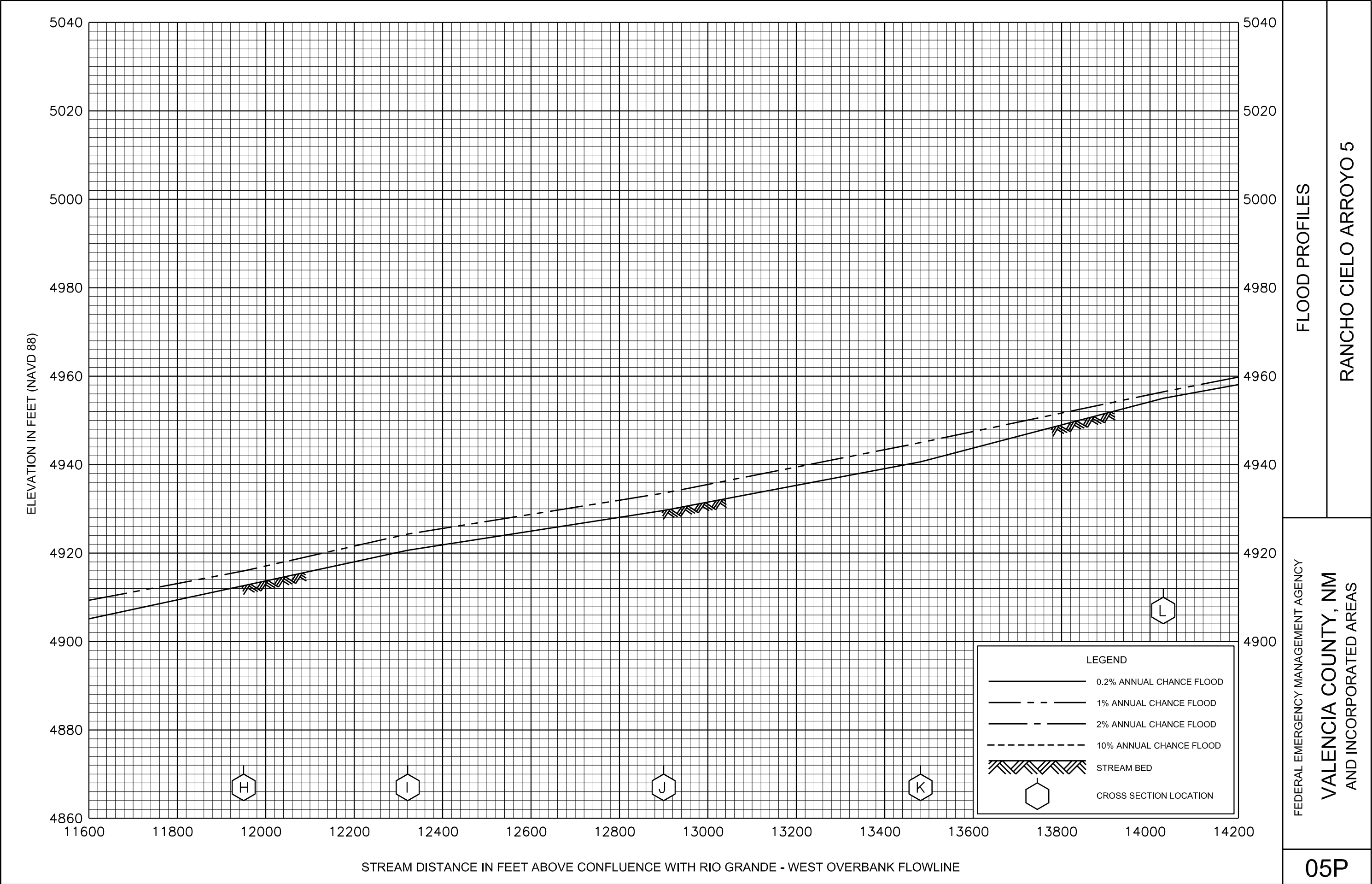
26. US Geological Survey. Water Supply Paper 2433, Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States. 1997.
27. U.S. Army Corps of Engineers, Middle Rio Grande, Digital Orthophoto Maps, Scale 1:6,000, Contour Interval 2 feet, and Scale 1:16,000, Contour Interval 4 feet, 1995.
28. U.S. Geological Survey, 10m and 30m National Elevation Dataset, August 2006, <http://gisdata.usgs.net/ned>, accessed April 2008.
29. Bohannon-Huston, Inc., Photogrammetry Division, 4125 Carlisle Boulevard, N.E., Albuquerque, New Mexico 87107.
30. Western State Aerial Surveys, P.O. Box 478, Gunnison, Colorado 81230.
31. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Interim Policy on Mapping Leveed Areas, October 1977.
32. Verbal Communication, John Cunico, Chief Flood Plain Management Branch, Engineering Division, U.S. Army Corps of Engineers, Albuquerque, New Mexico, July 30, 1981.
33. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Belen, New Mexico, 1952, Photo revised 1971; Tome, New Mexico, 1952; Veguita, New Mexico, 1952, Photo revised 1971; Turn, New Mexico, 1952.
34. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Unincorporated Areas of Valencia County, New Mexico, June 15, 1984.
35. A. M. Kinney, Inc., Determination and Evaluation of Flood Protection Alternatives for the Middle Rio Grande Floodway, Bernalillo to Belen, New Mexico: Hydrology and Hydraulics, Cincinnati, Ohio, February 1977.

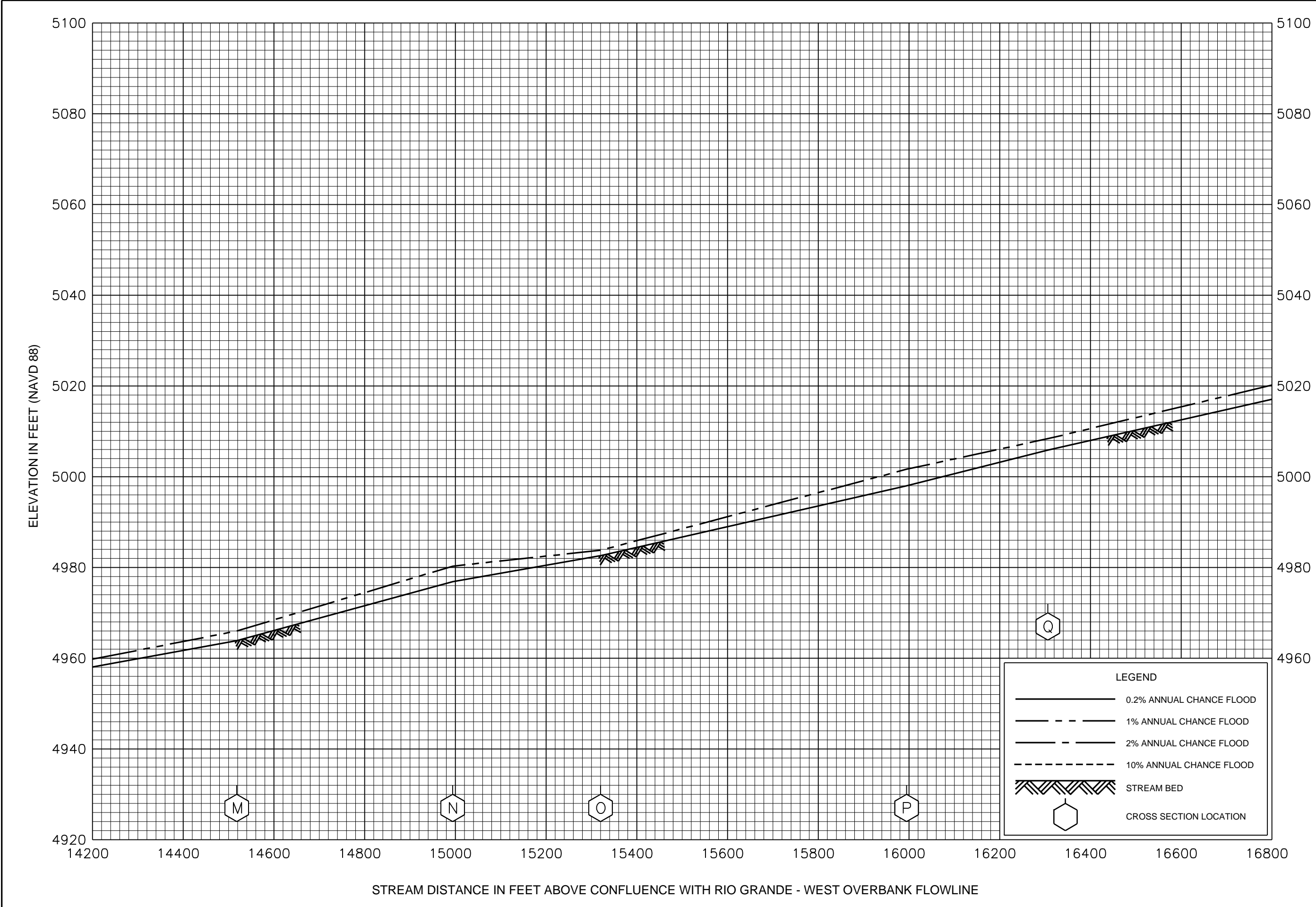


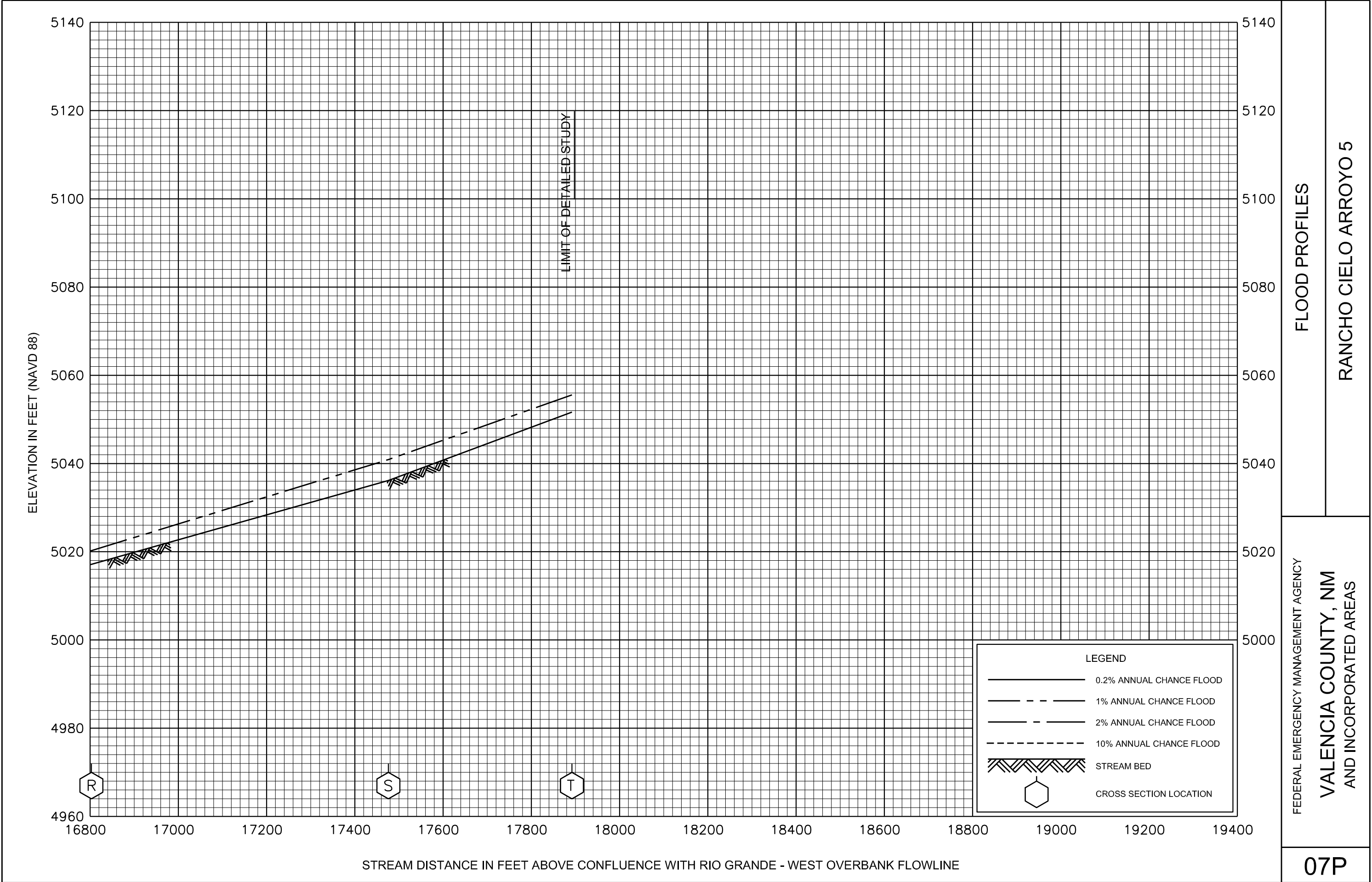


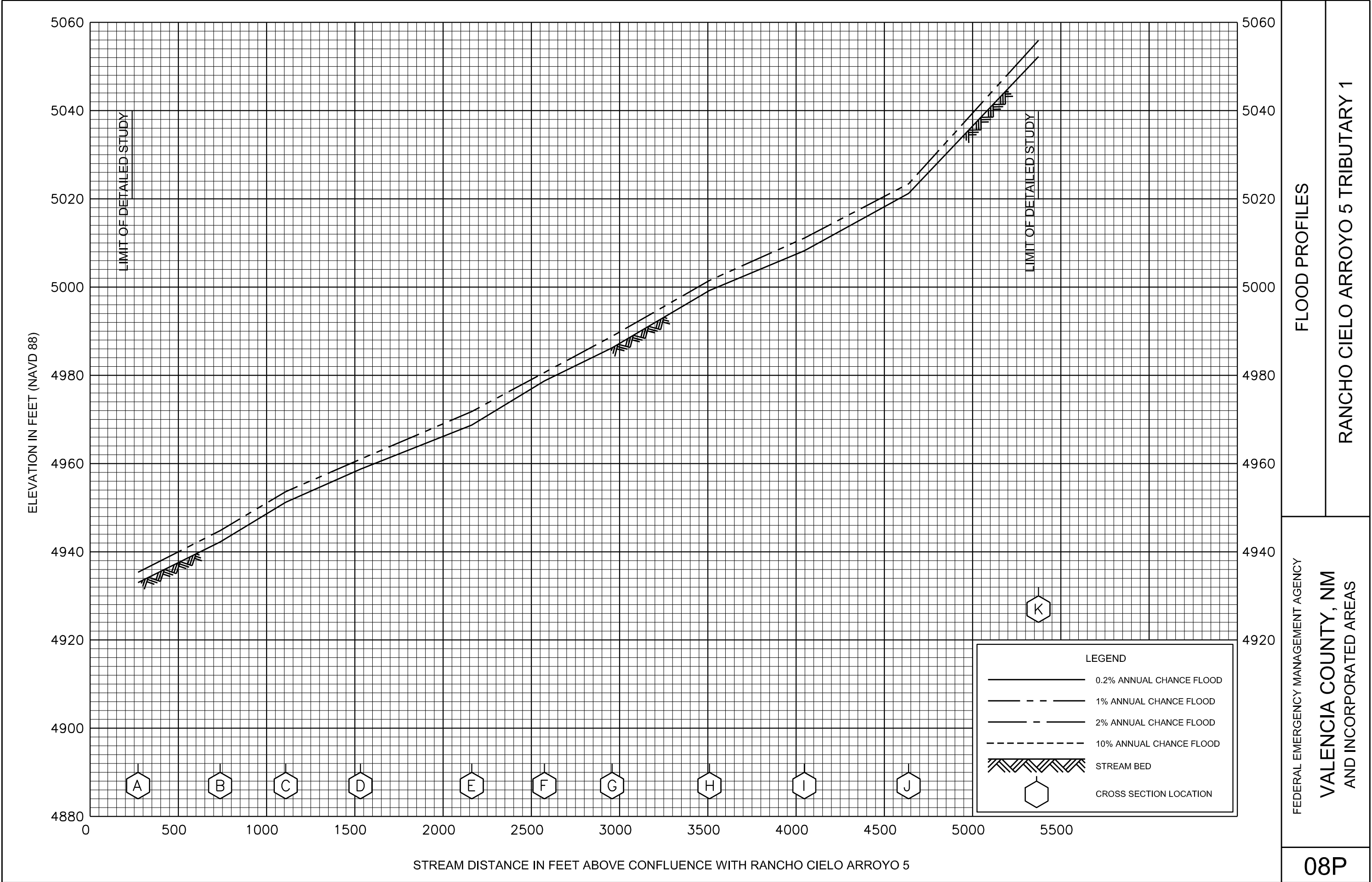


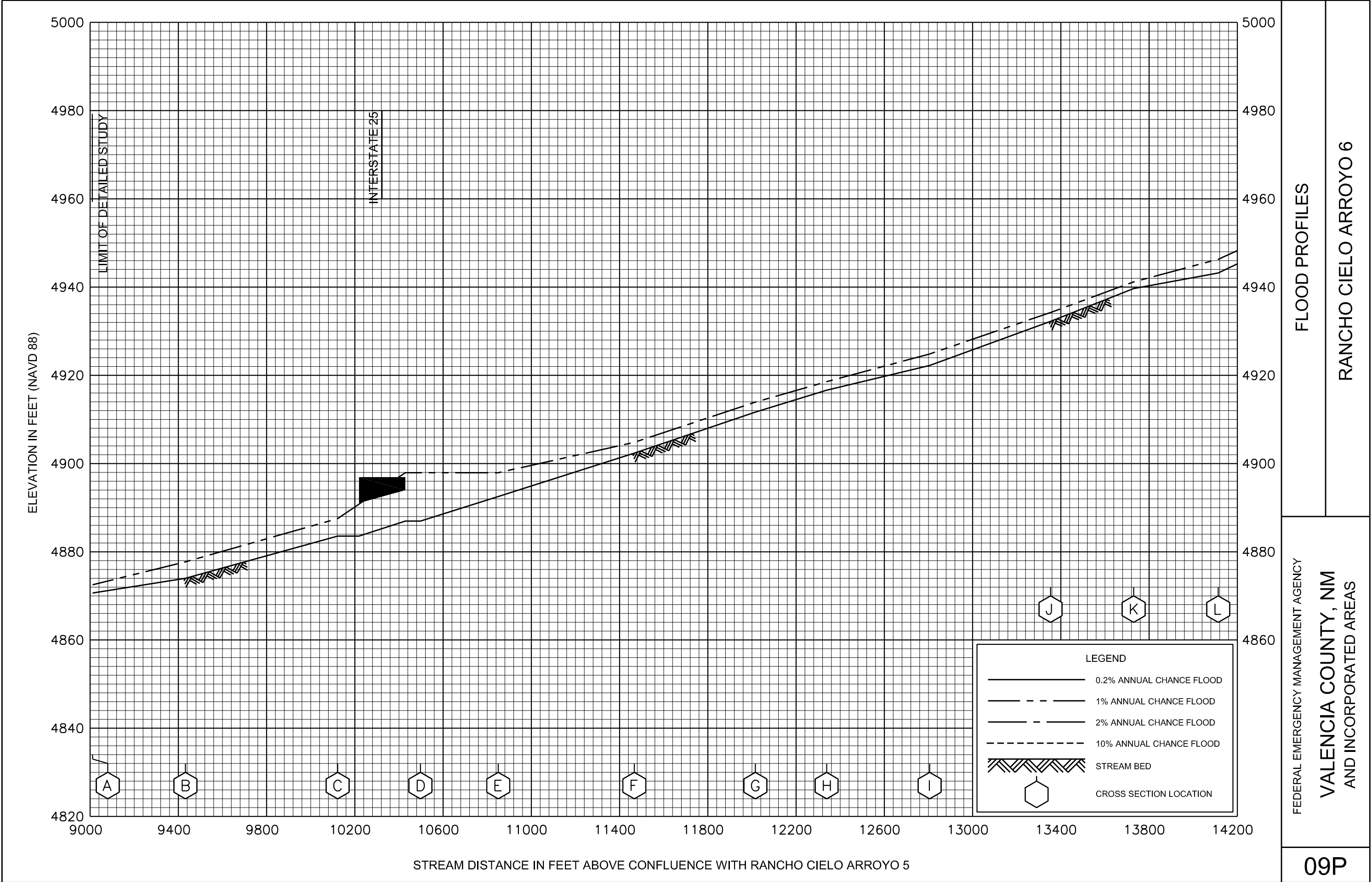


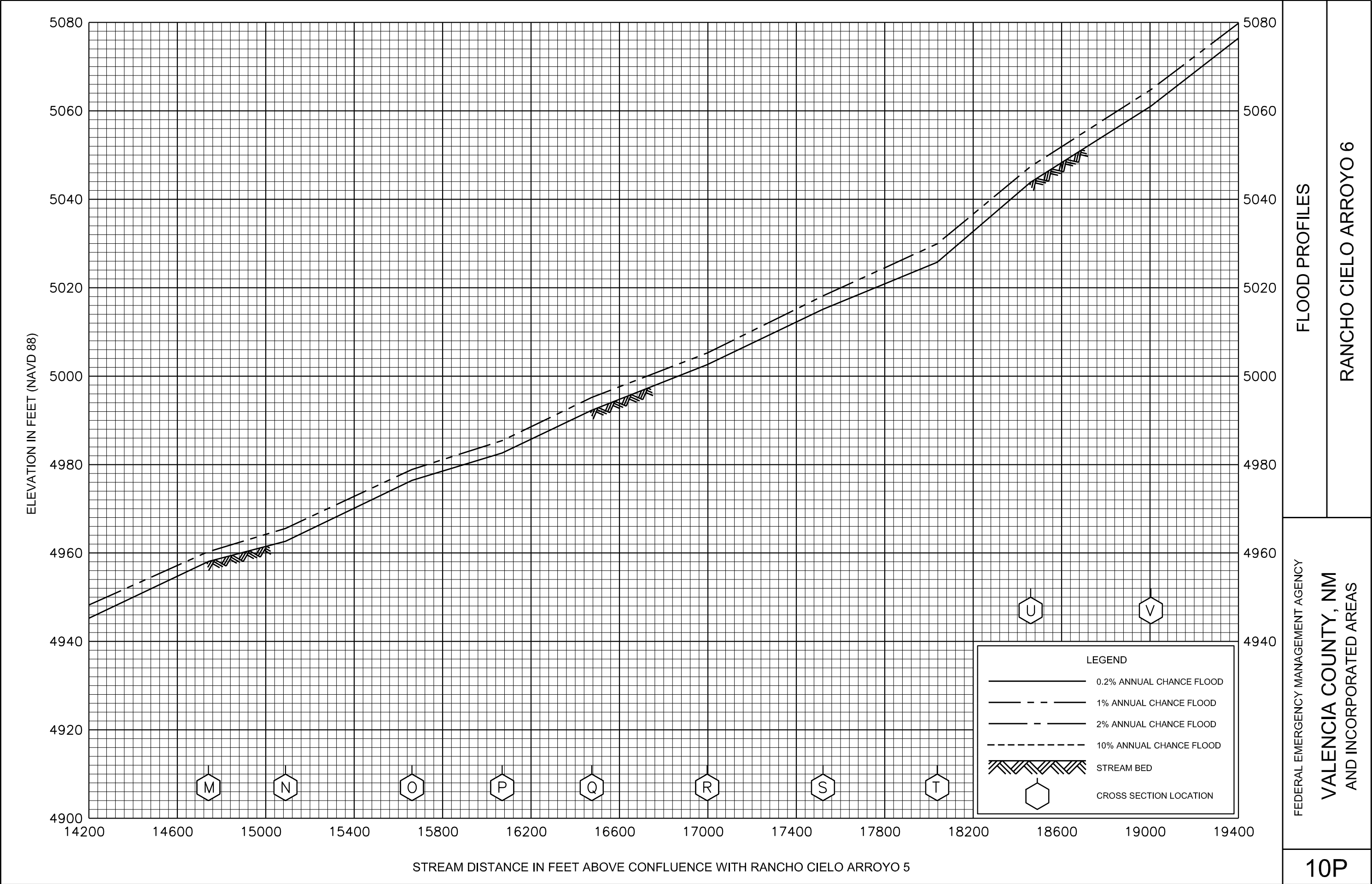


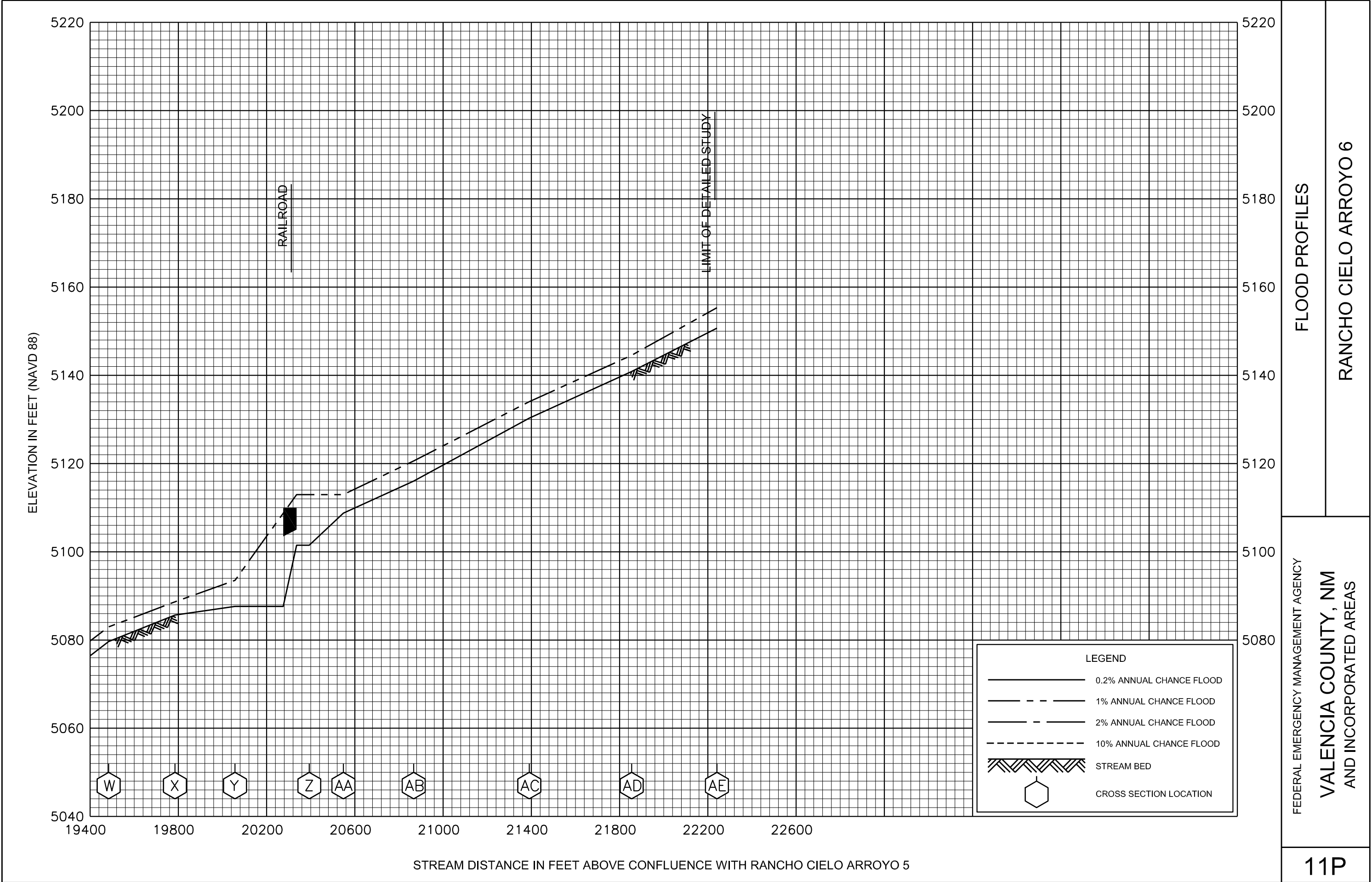


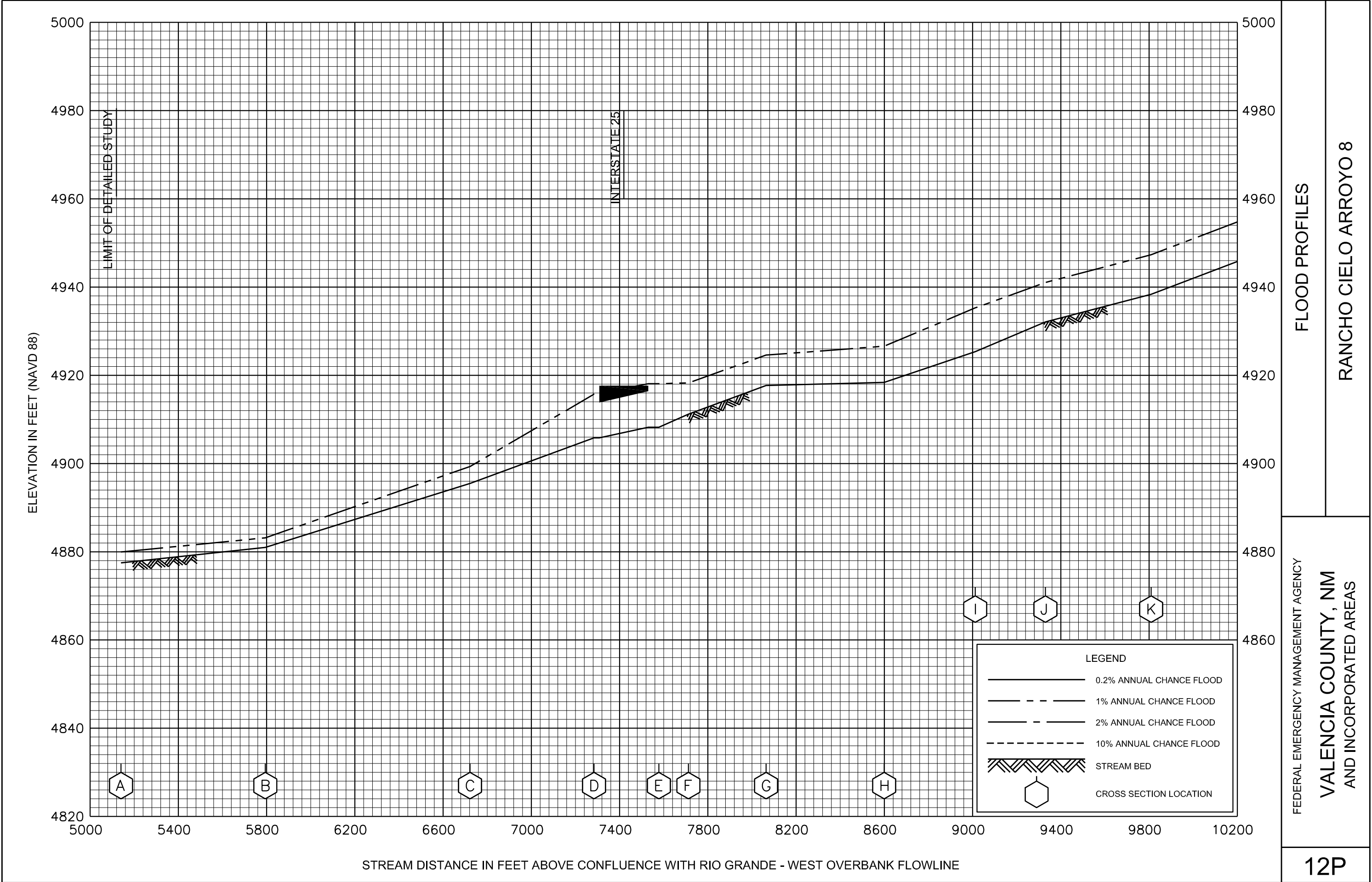


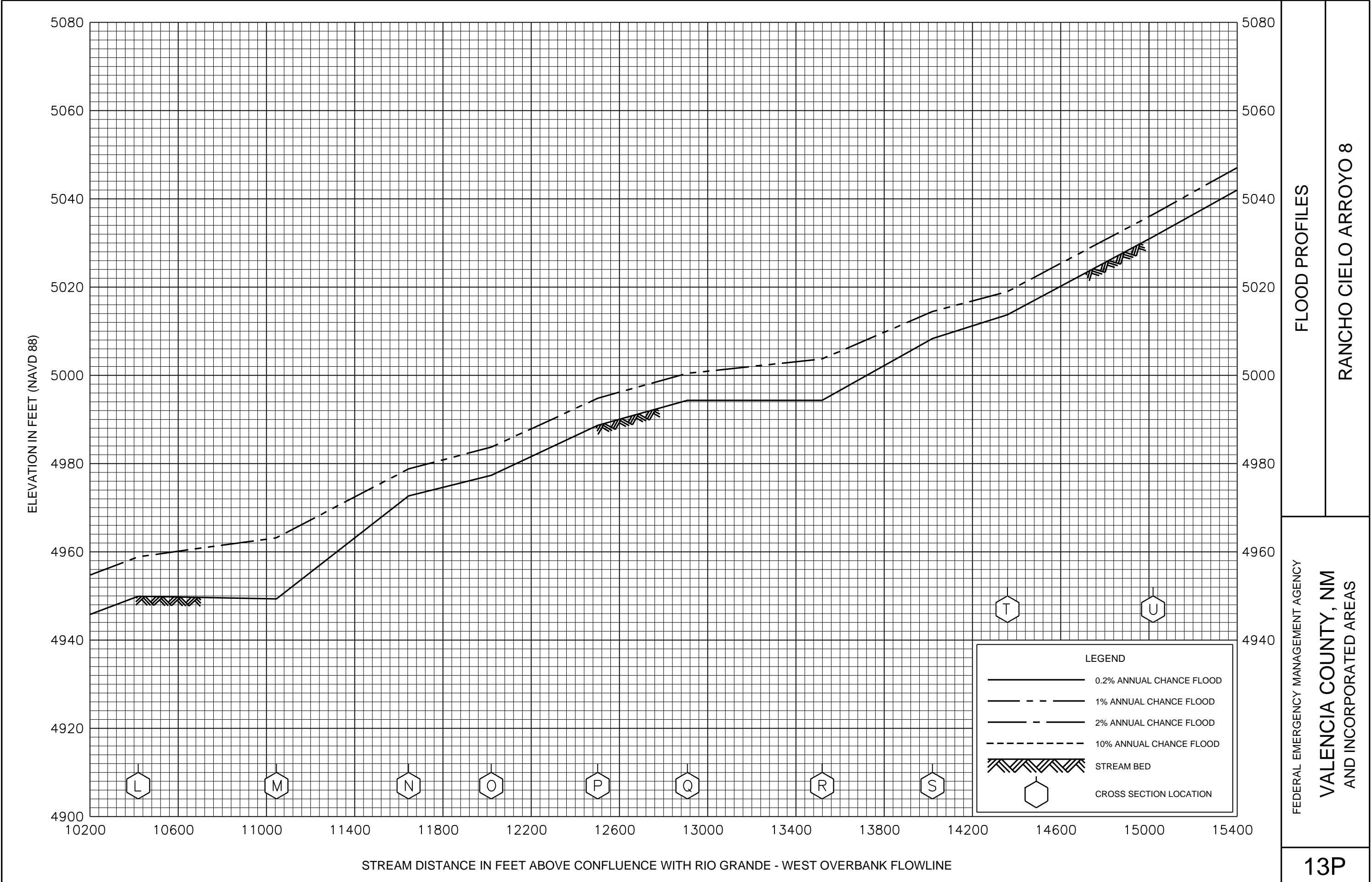


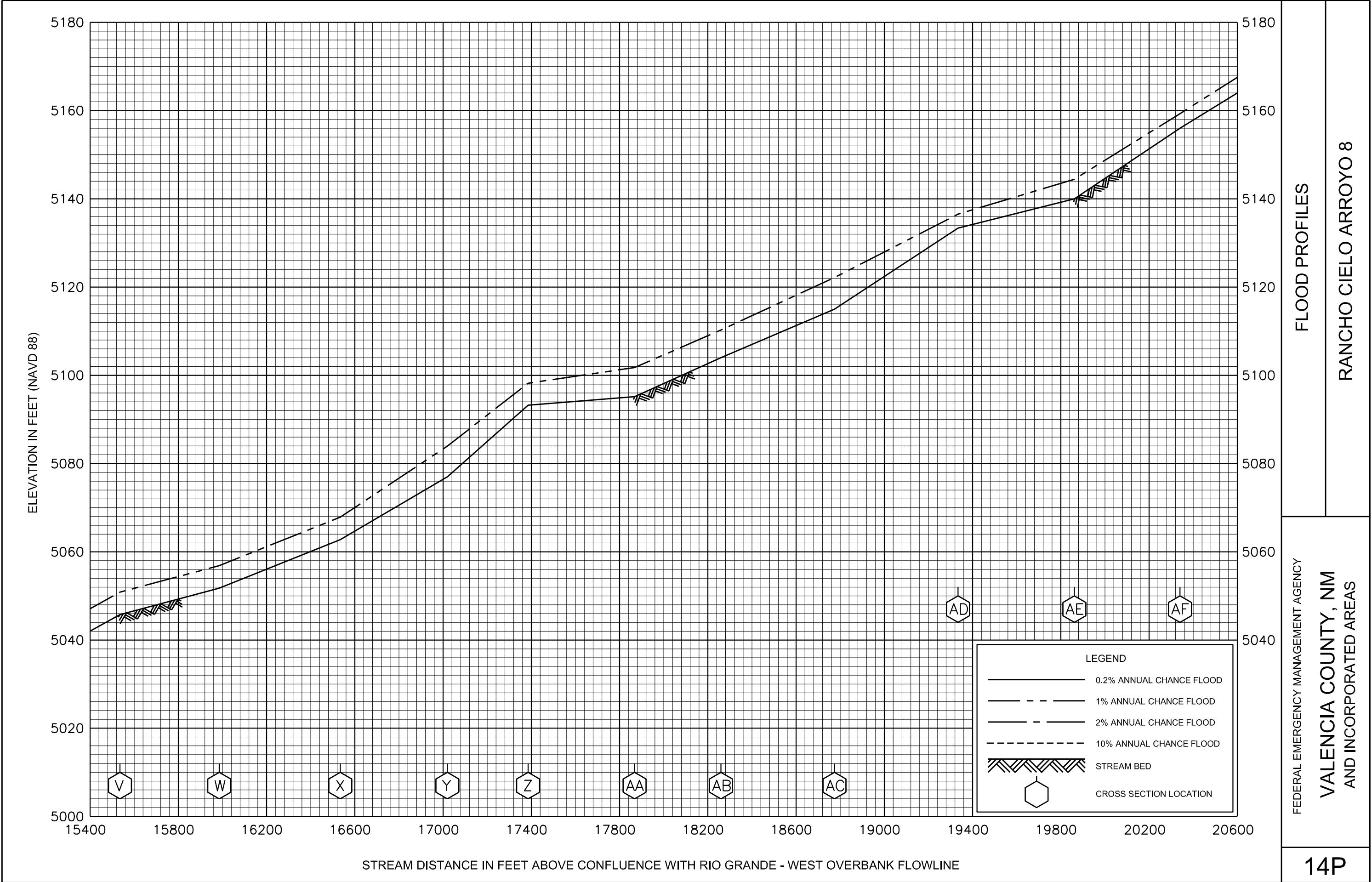


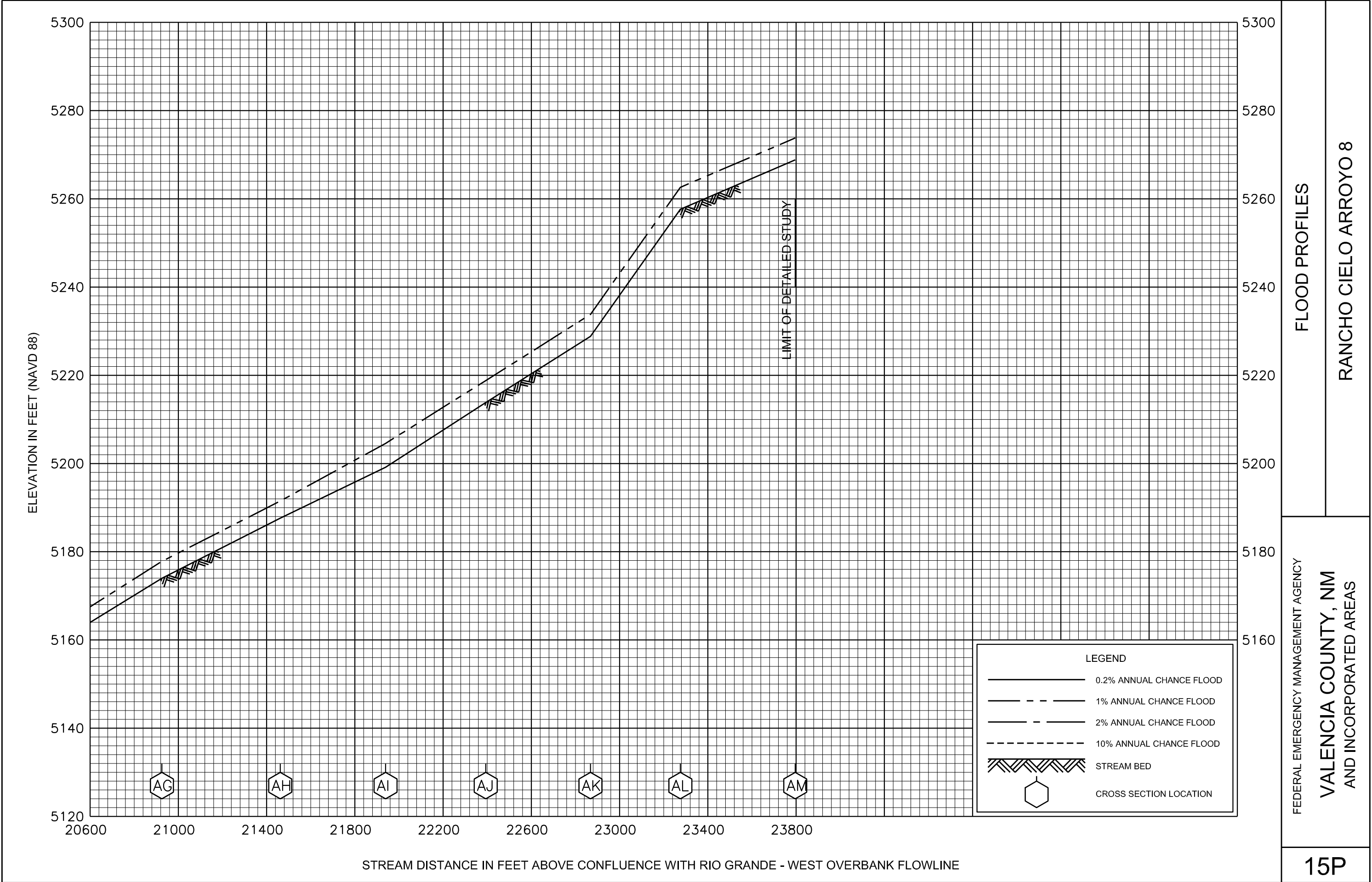


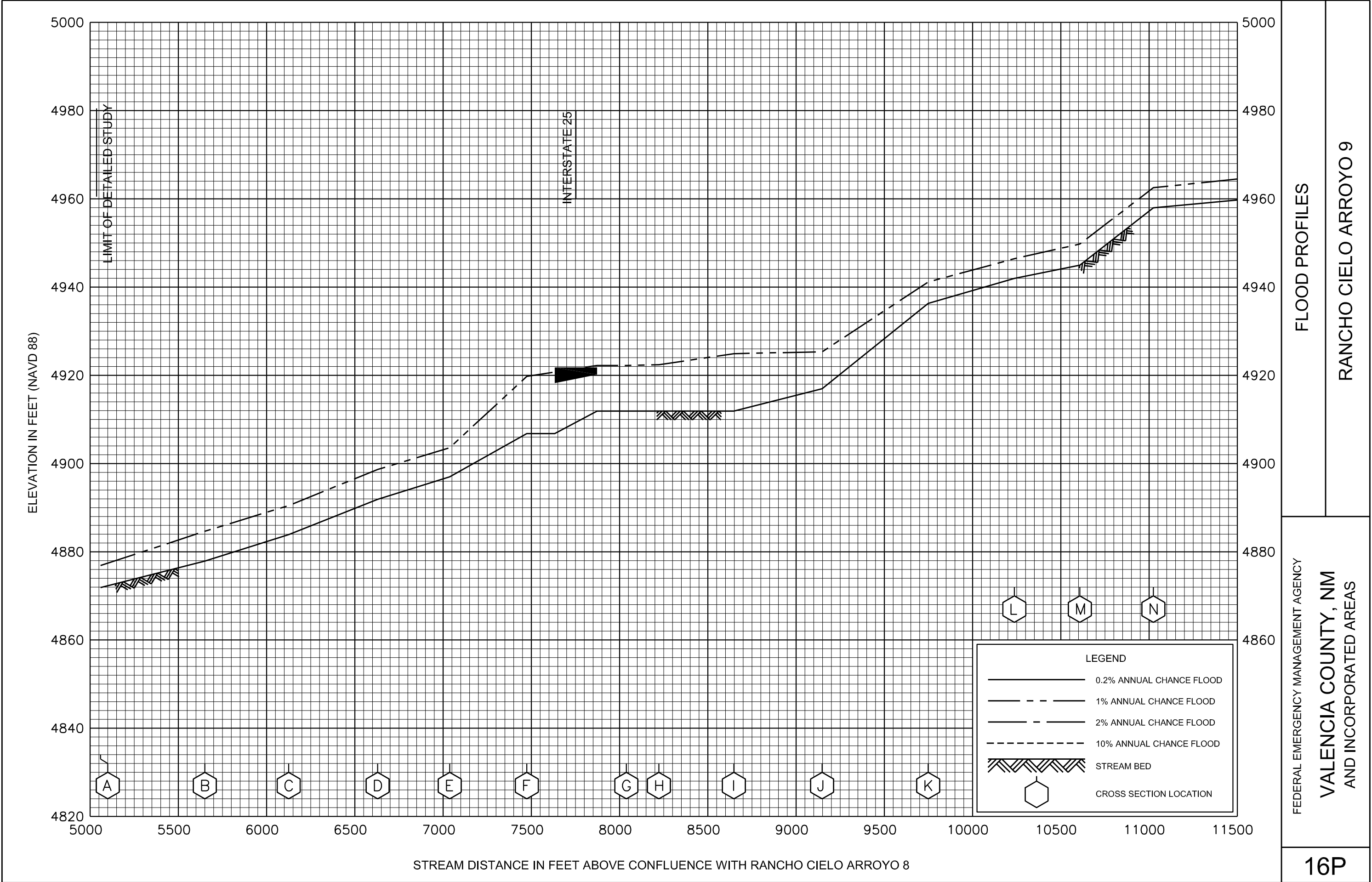


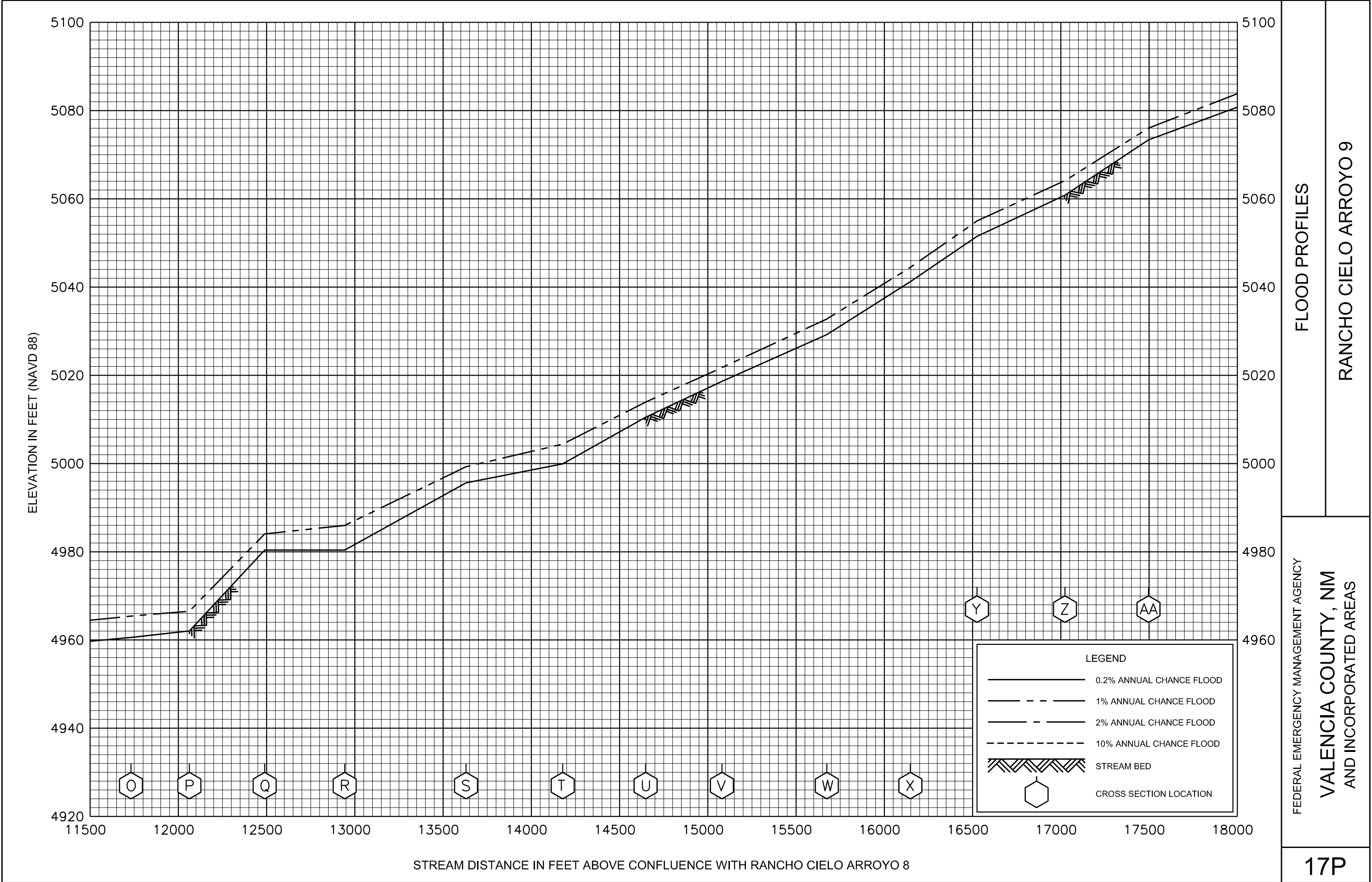


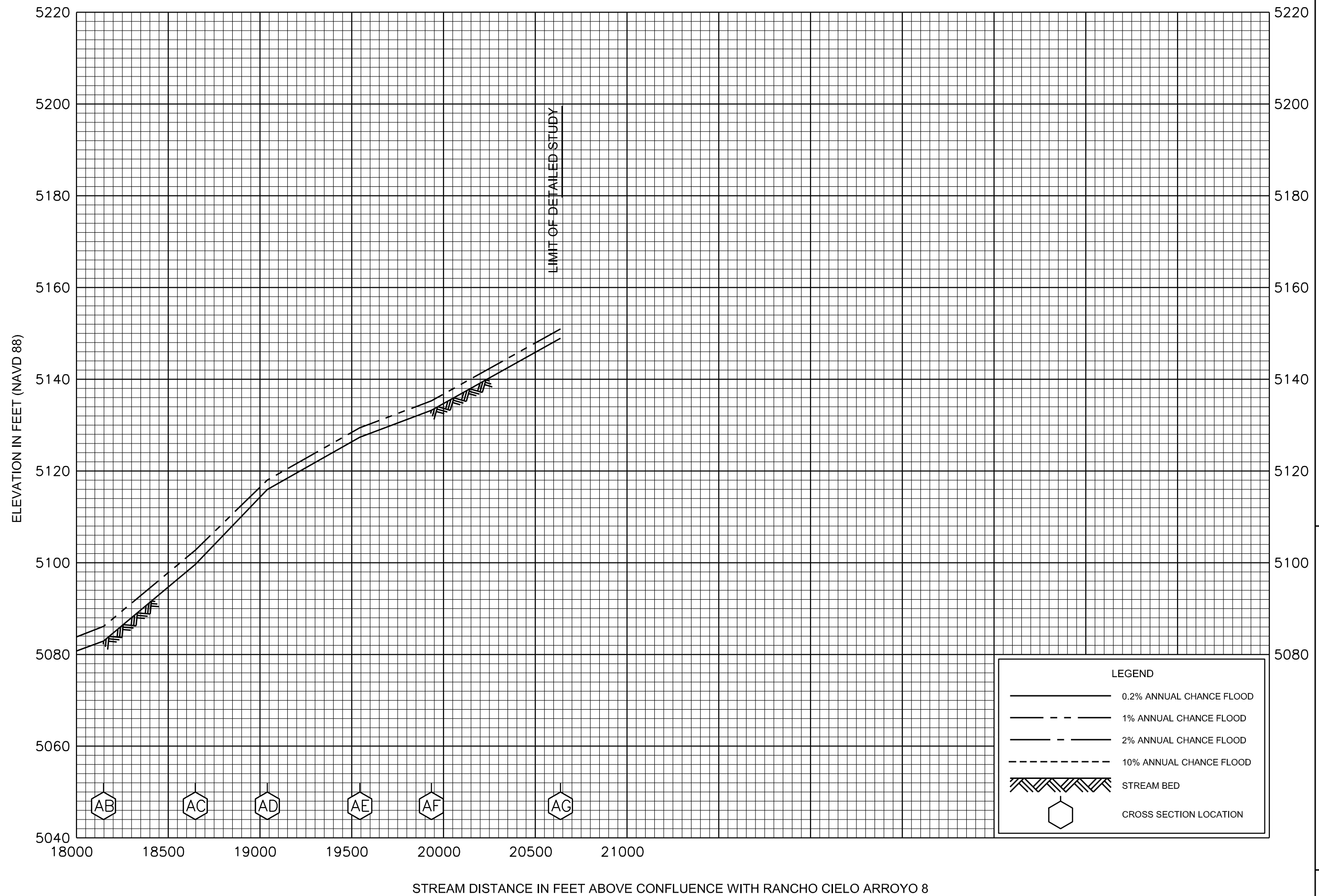












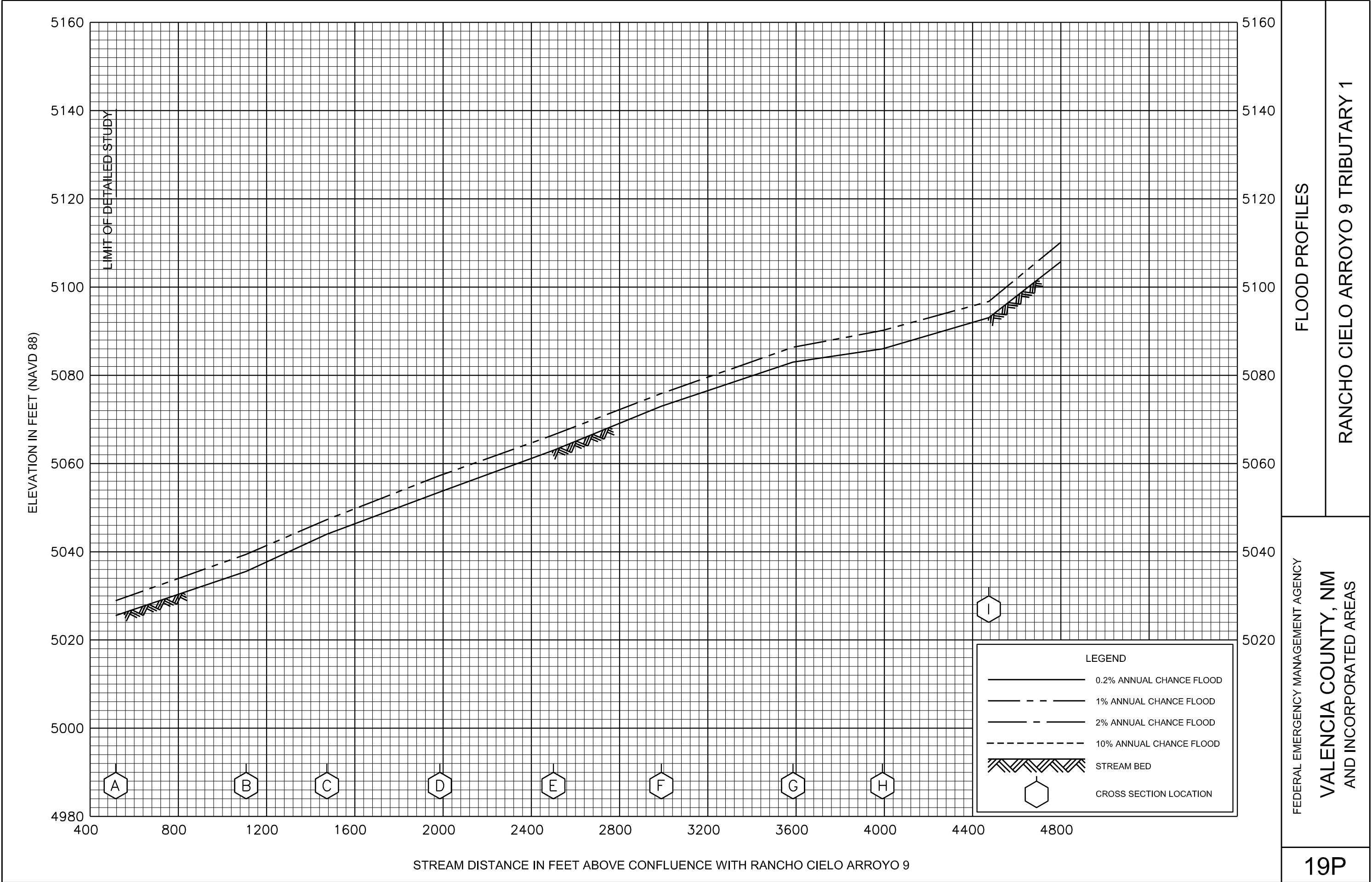
FEDERAL EMERGENCY MANAGEMENT AGENCY

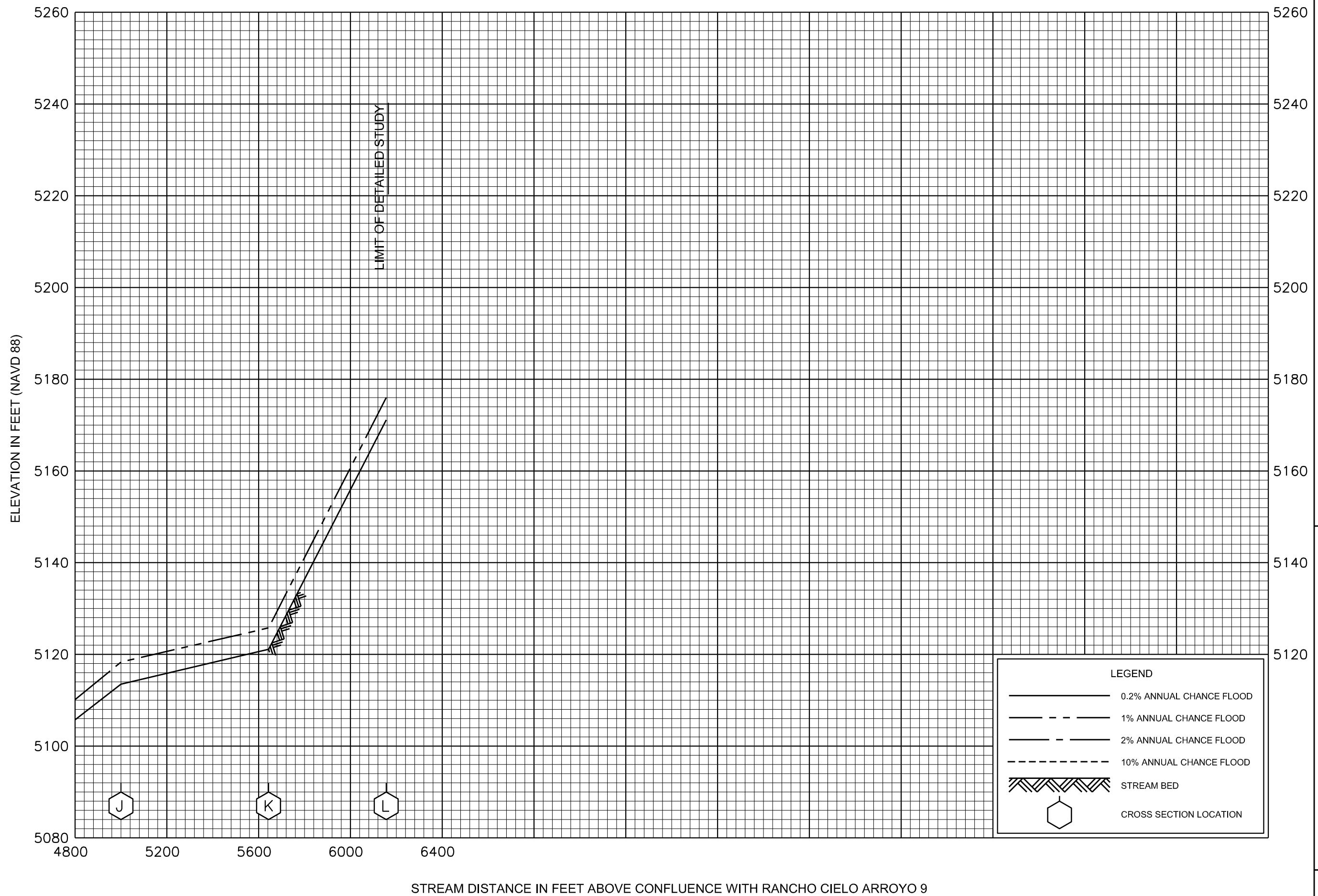
VALENCIA COUNTY, NM AND INCORPORATED AREAS

FLOOD PROFILES

RANCHO CIELO ARROYO 9

18P





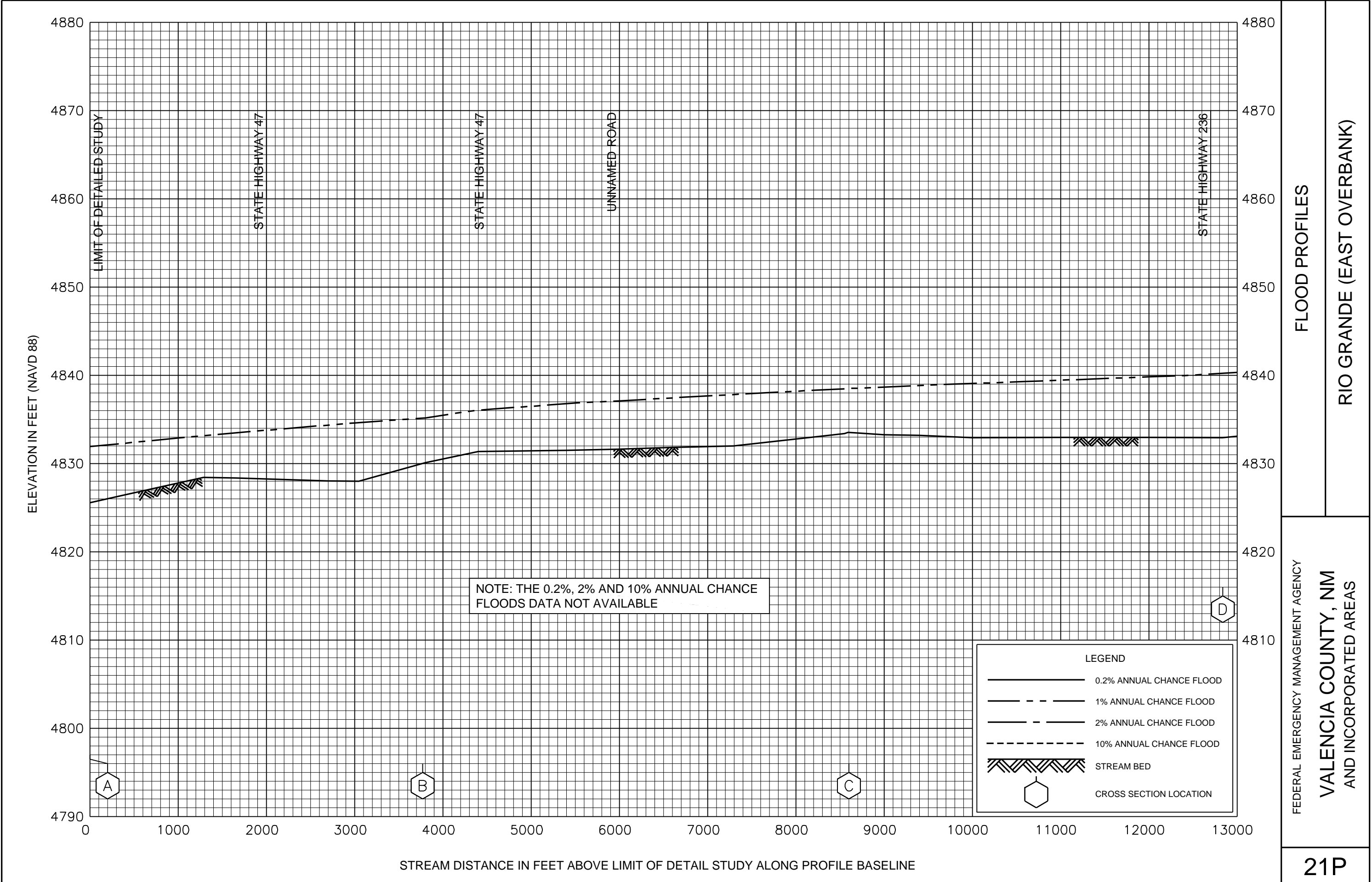
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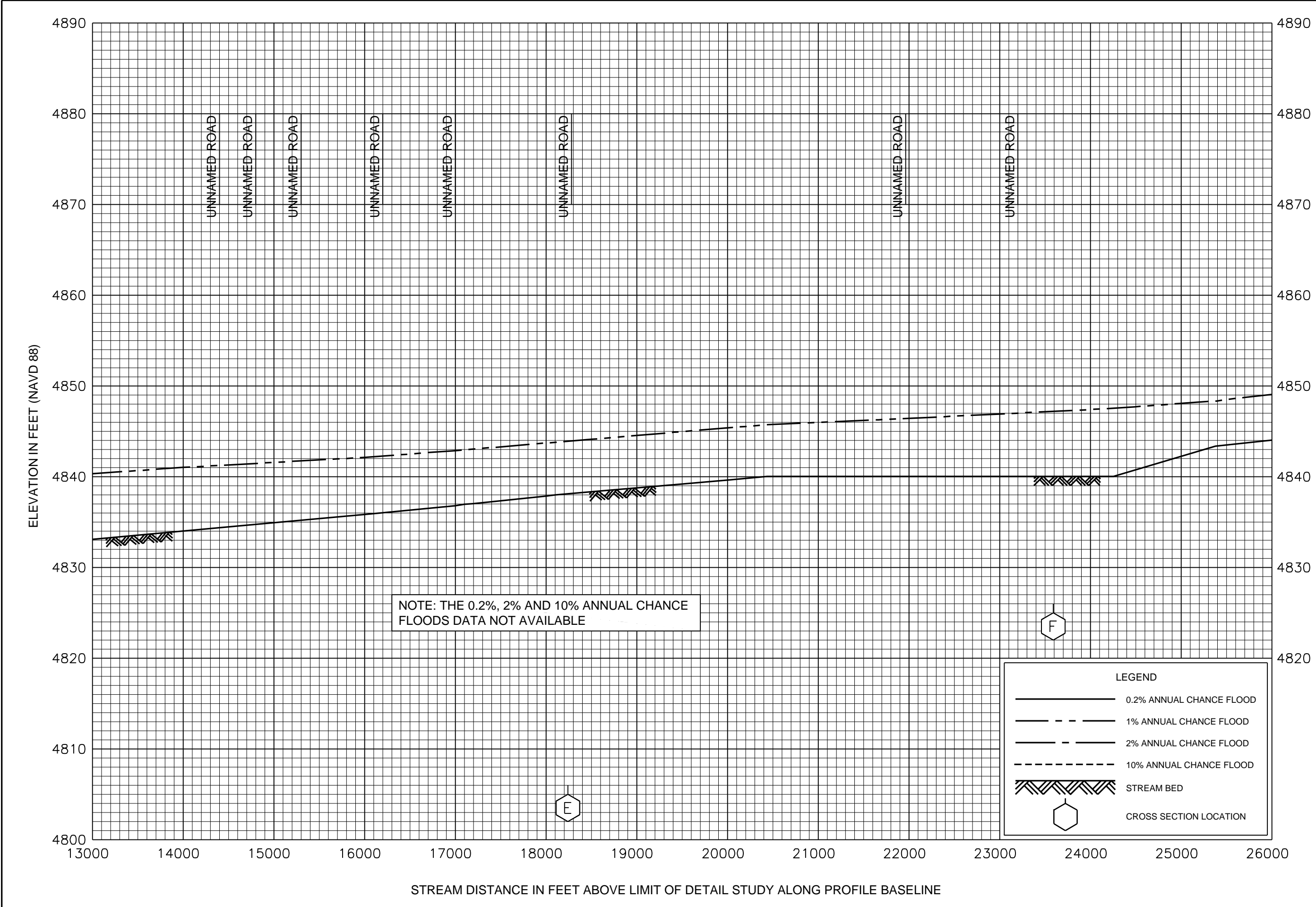
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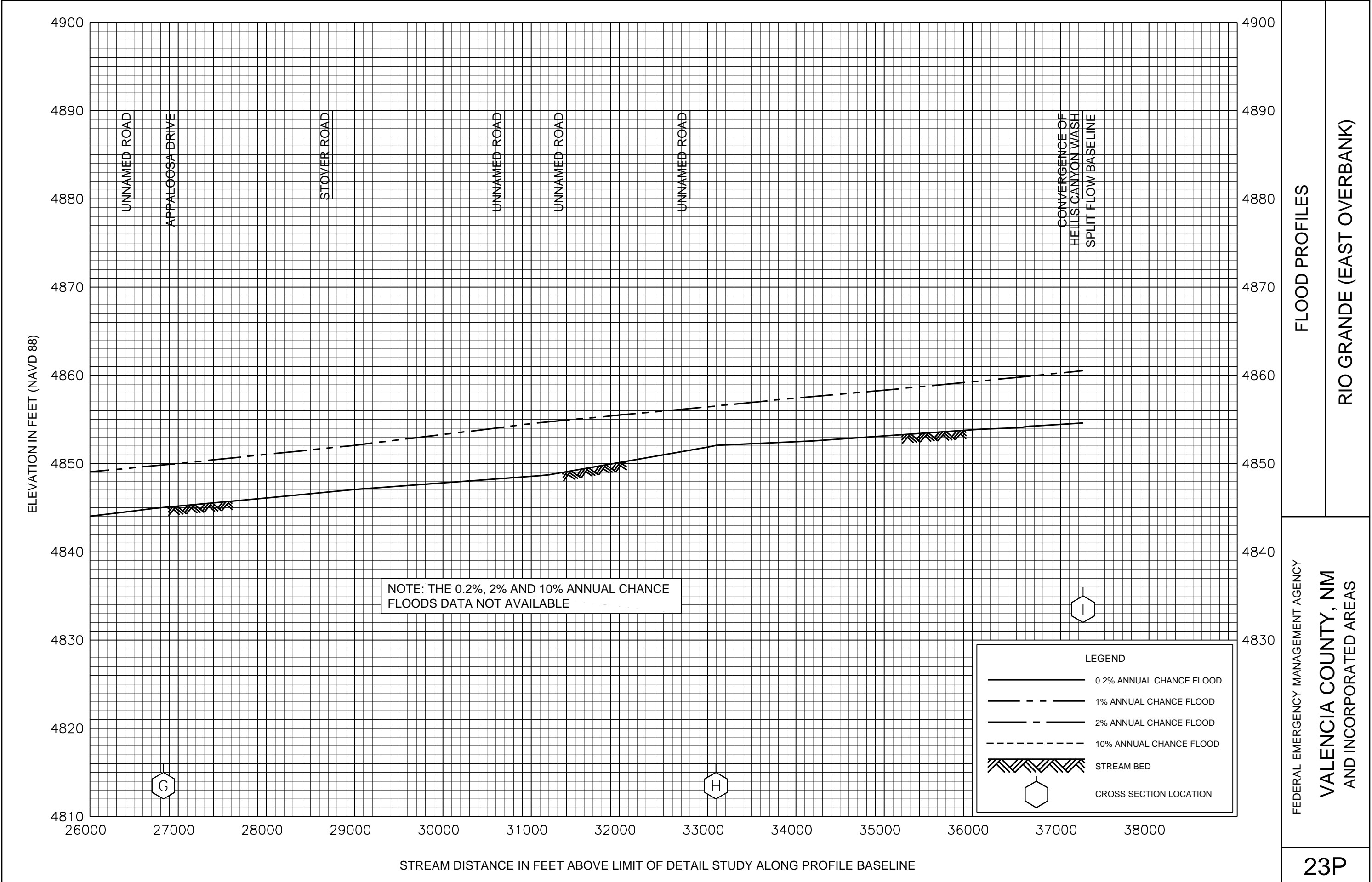
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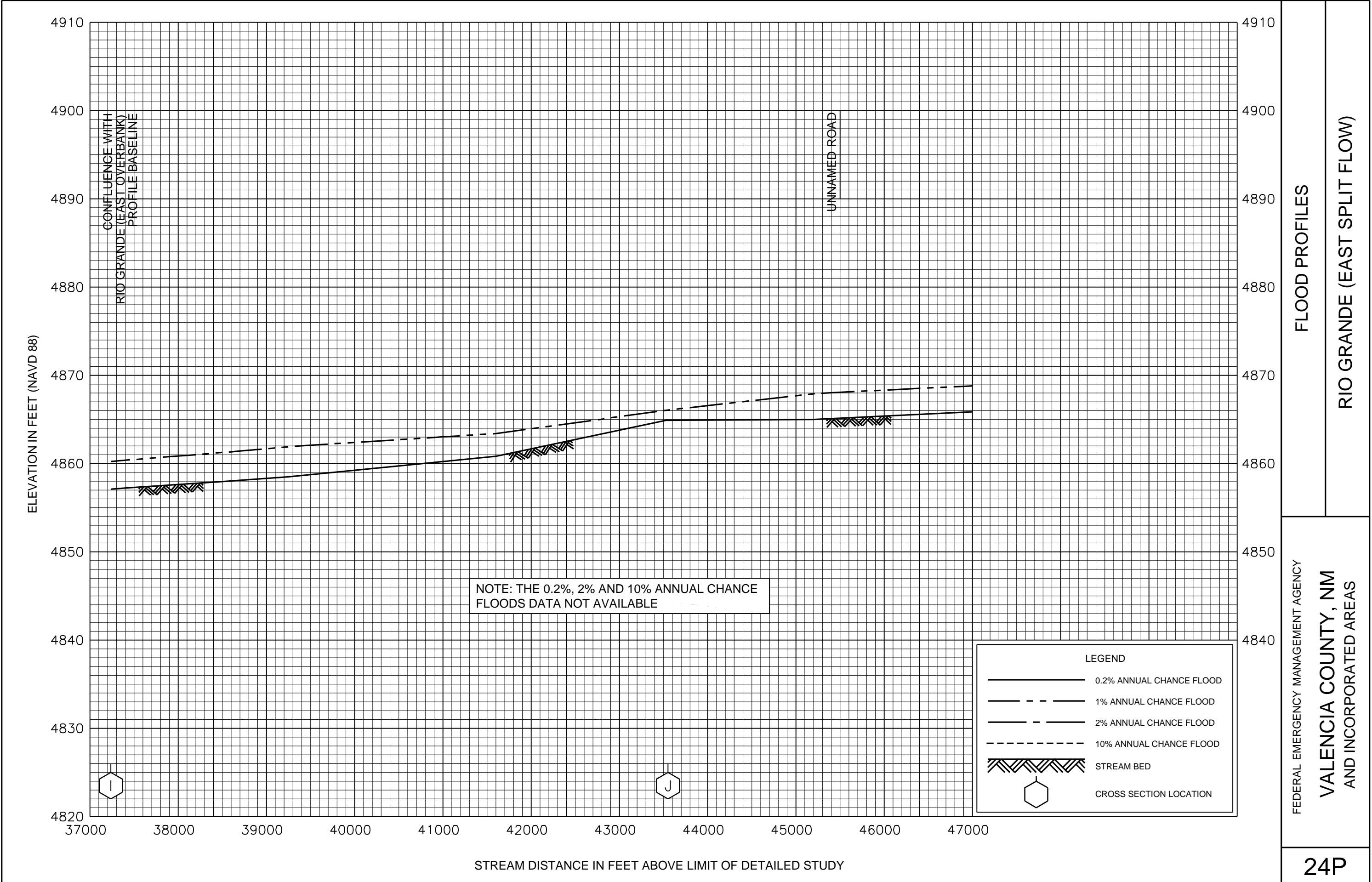
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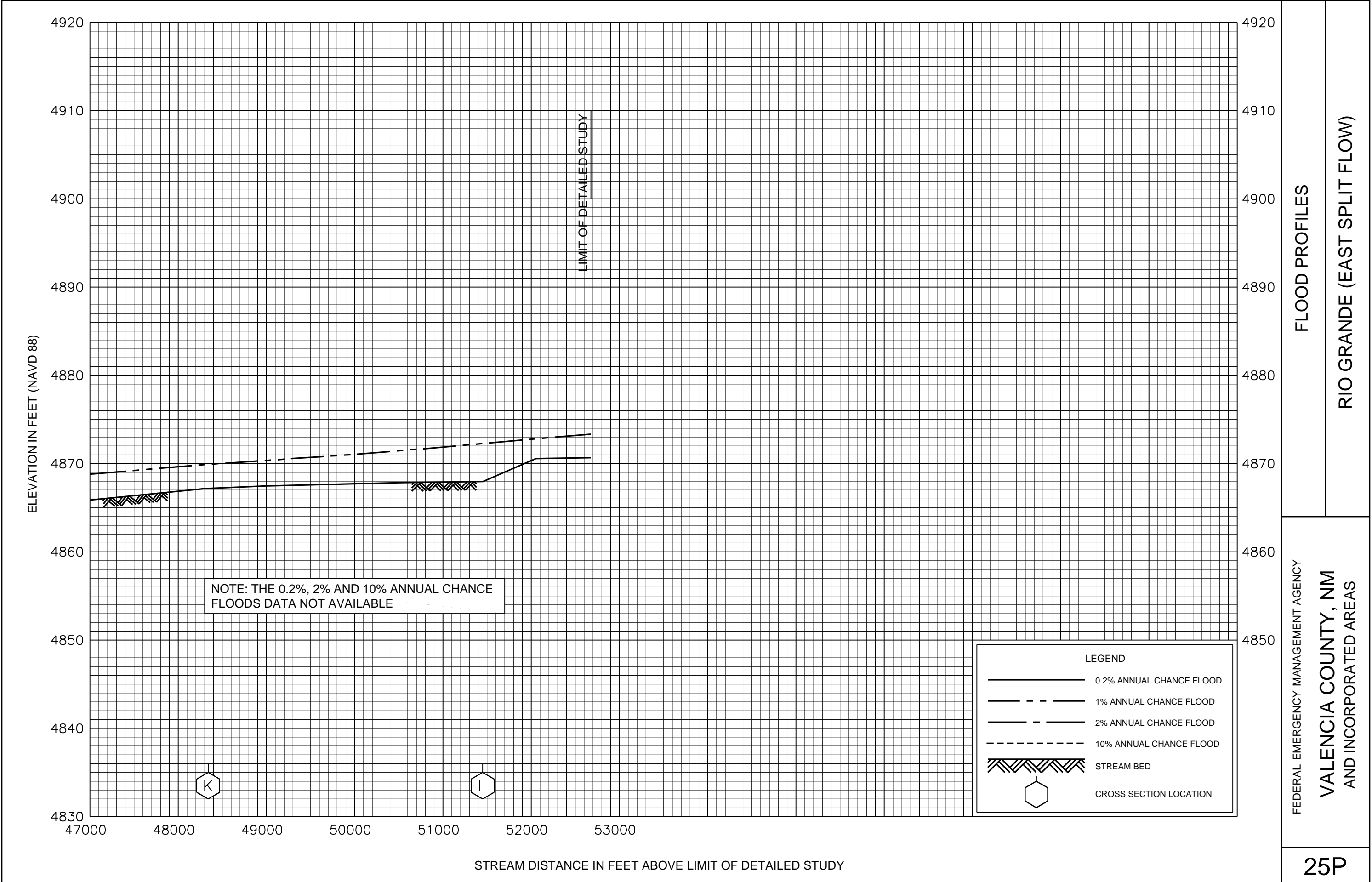
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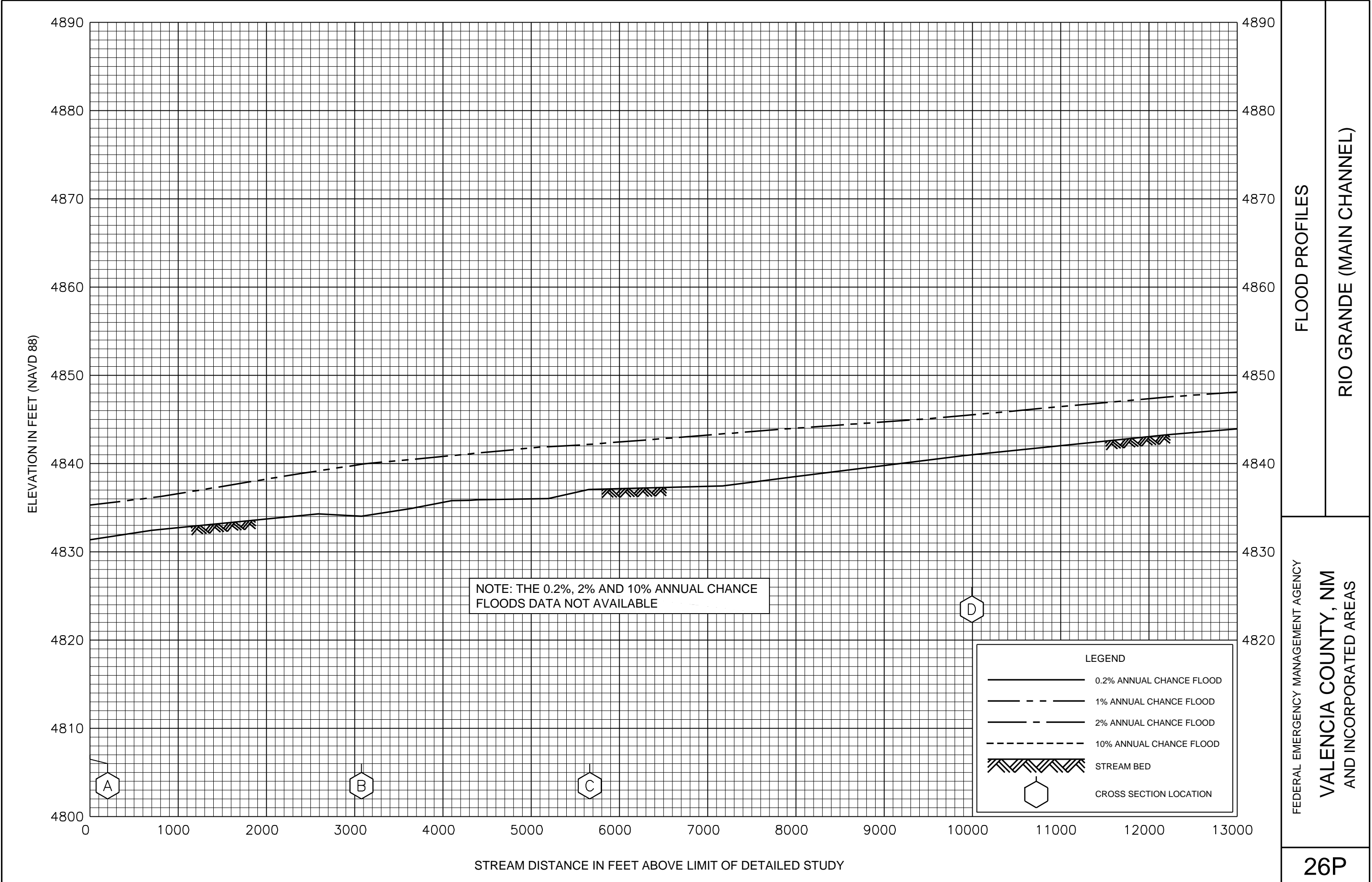


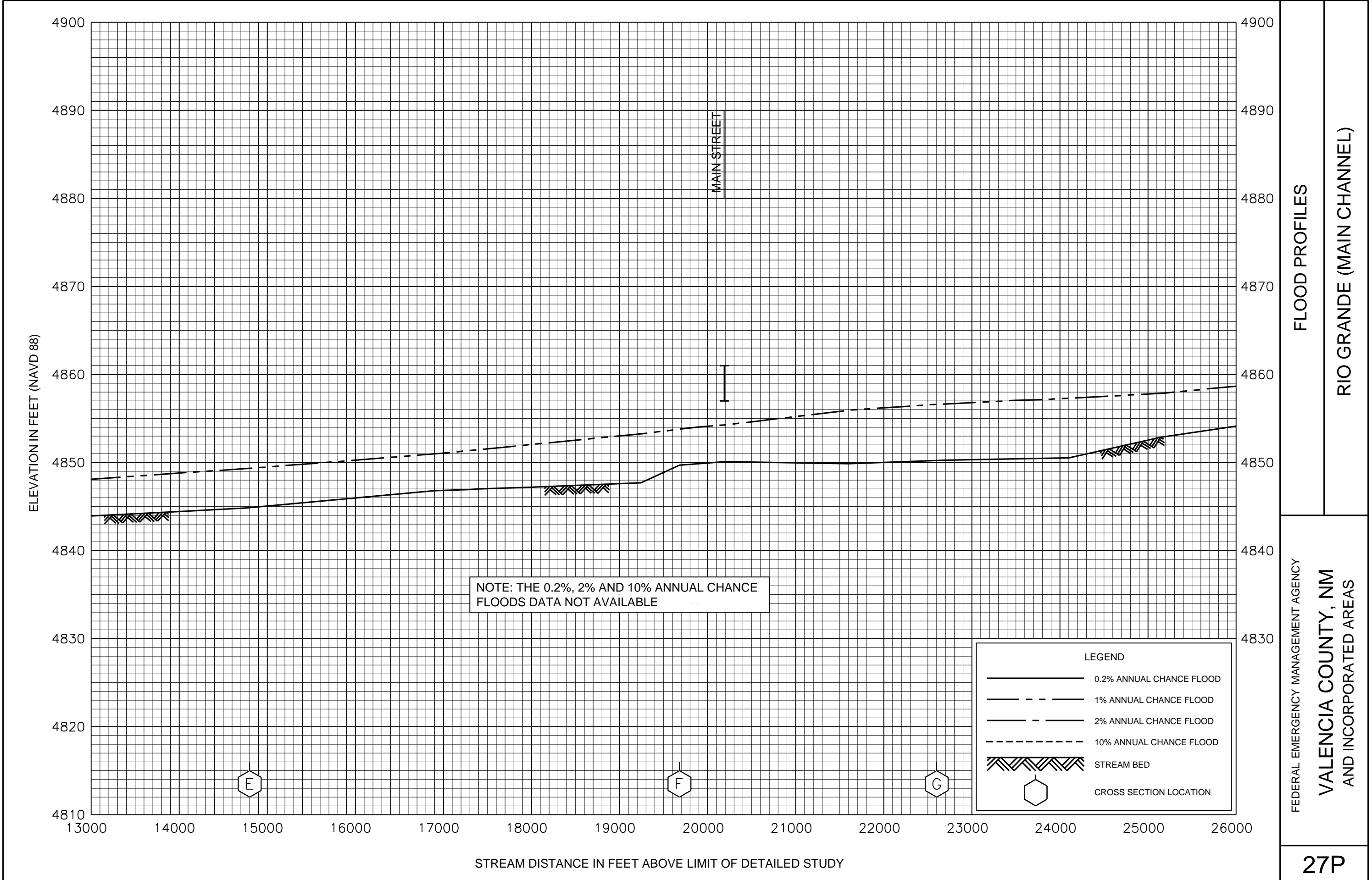


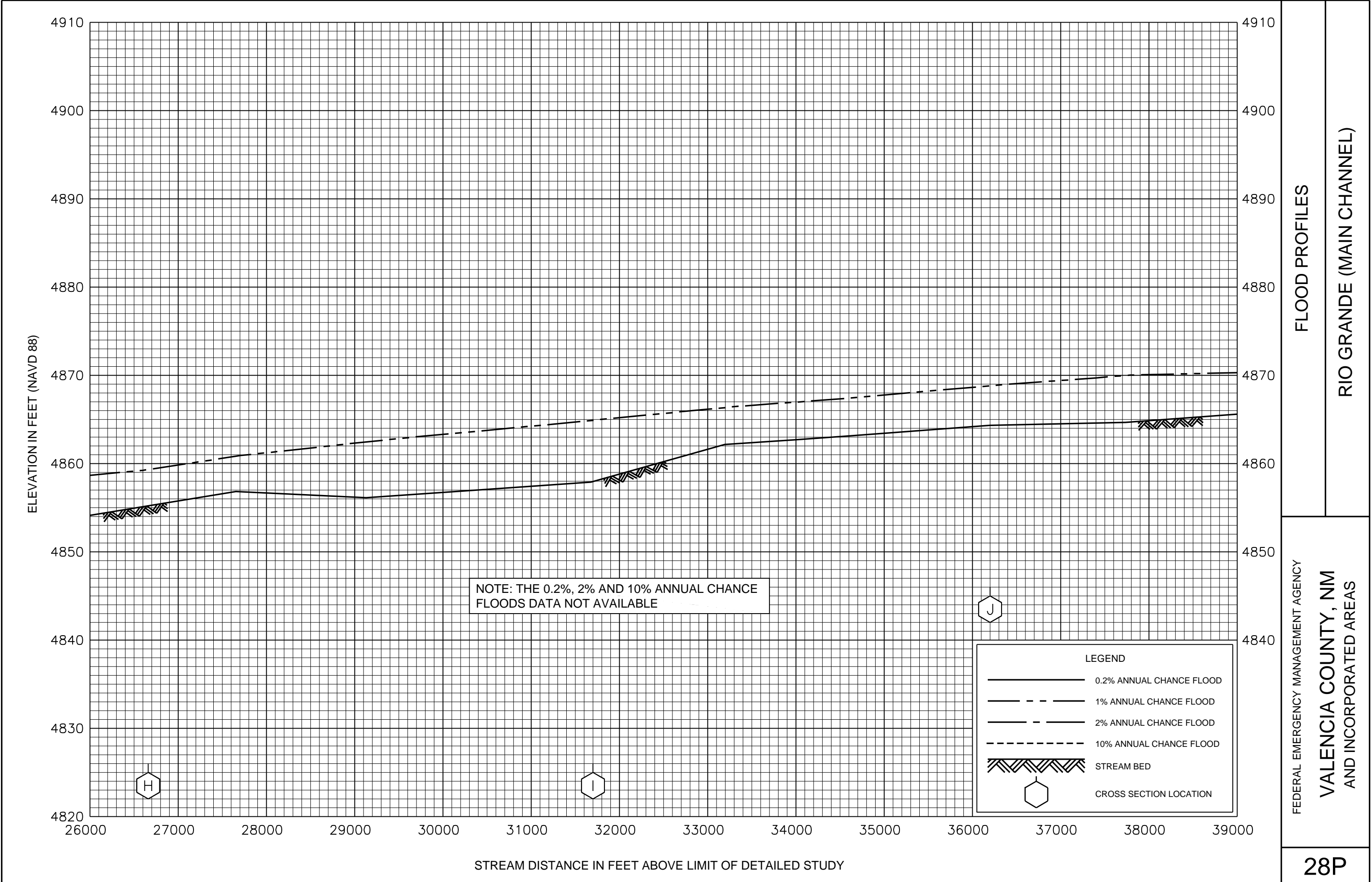


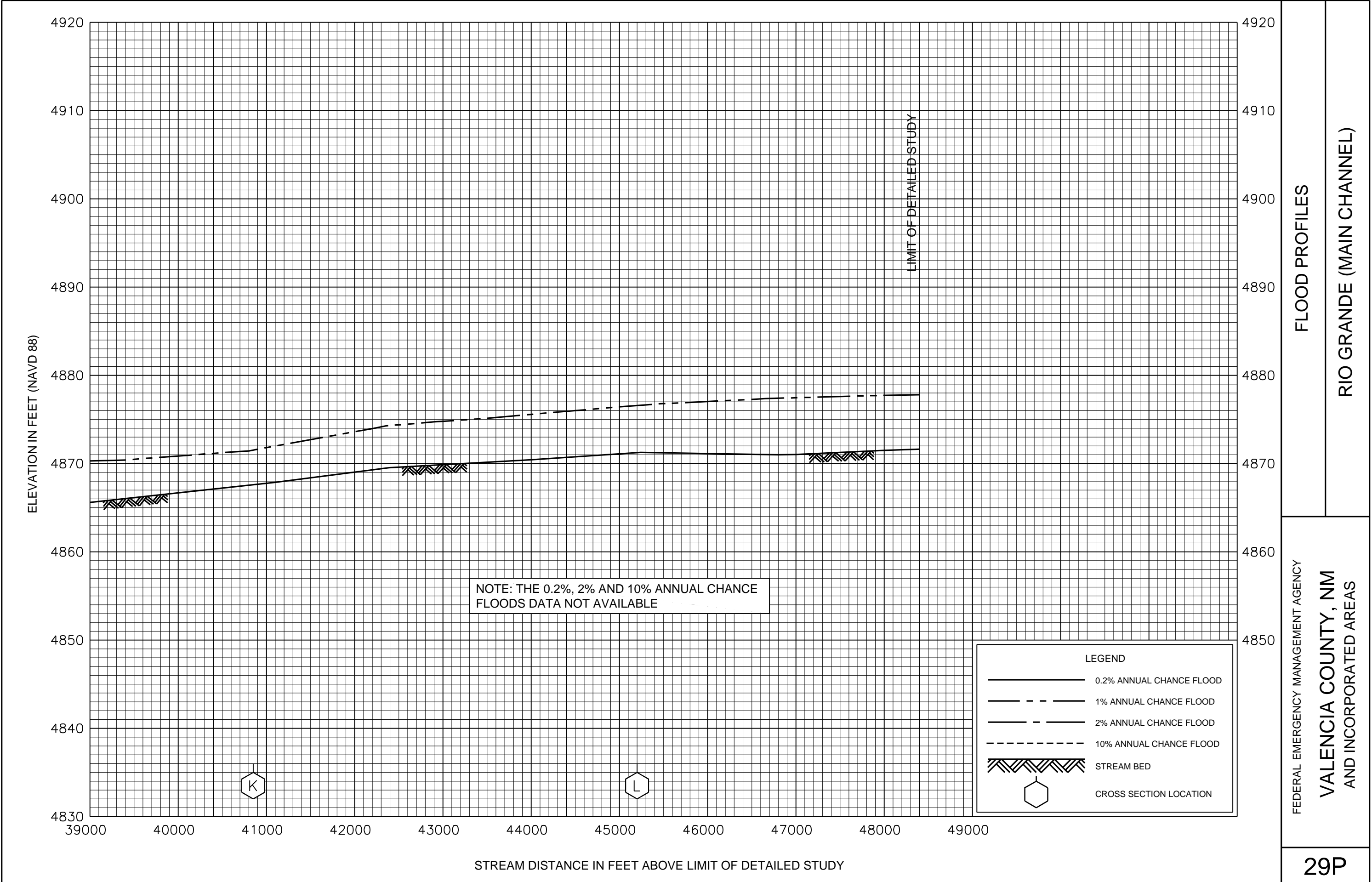


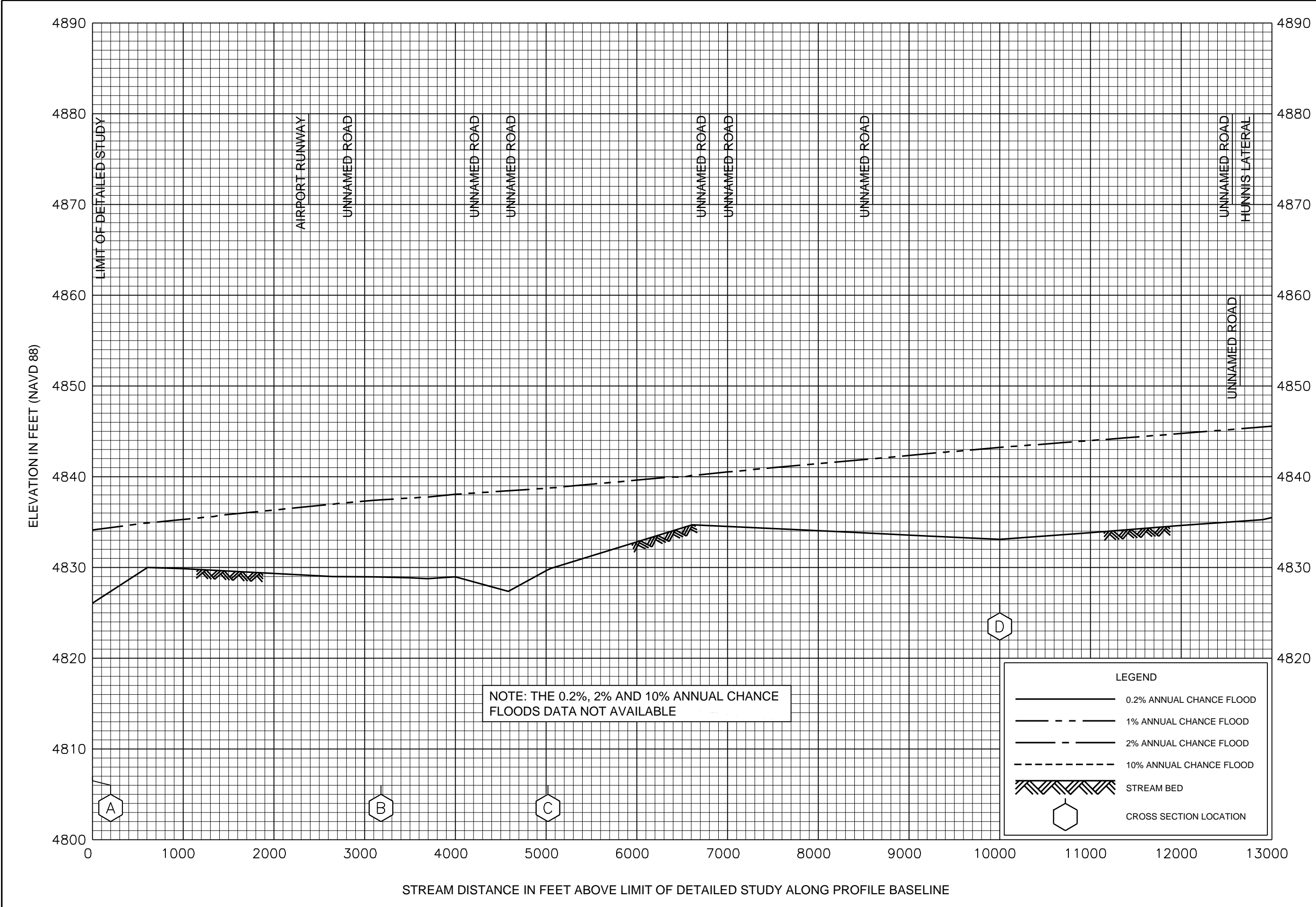


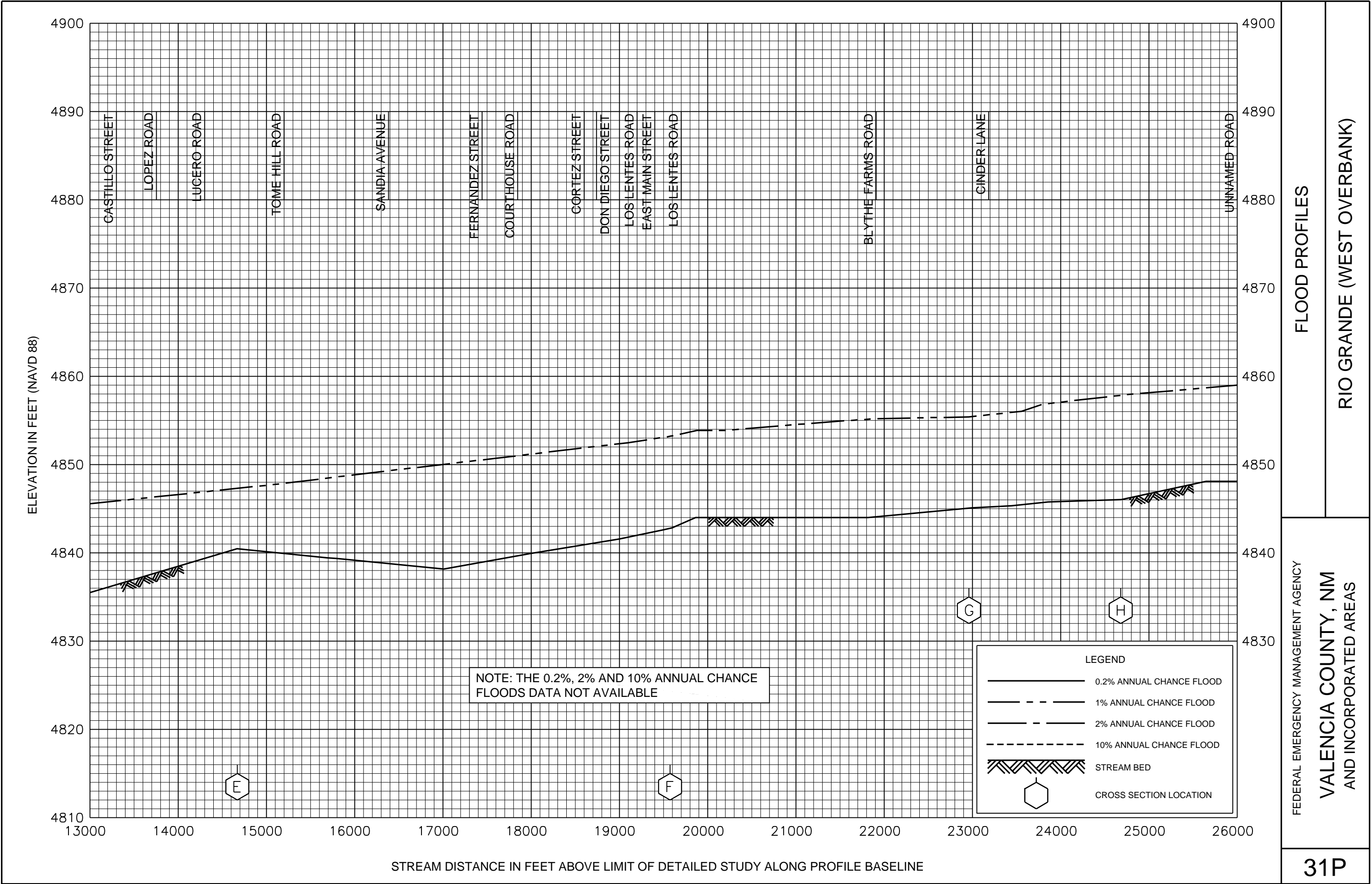


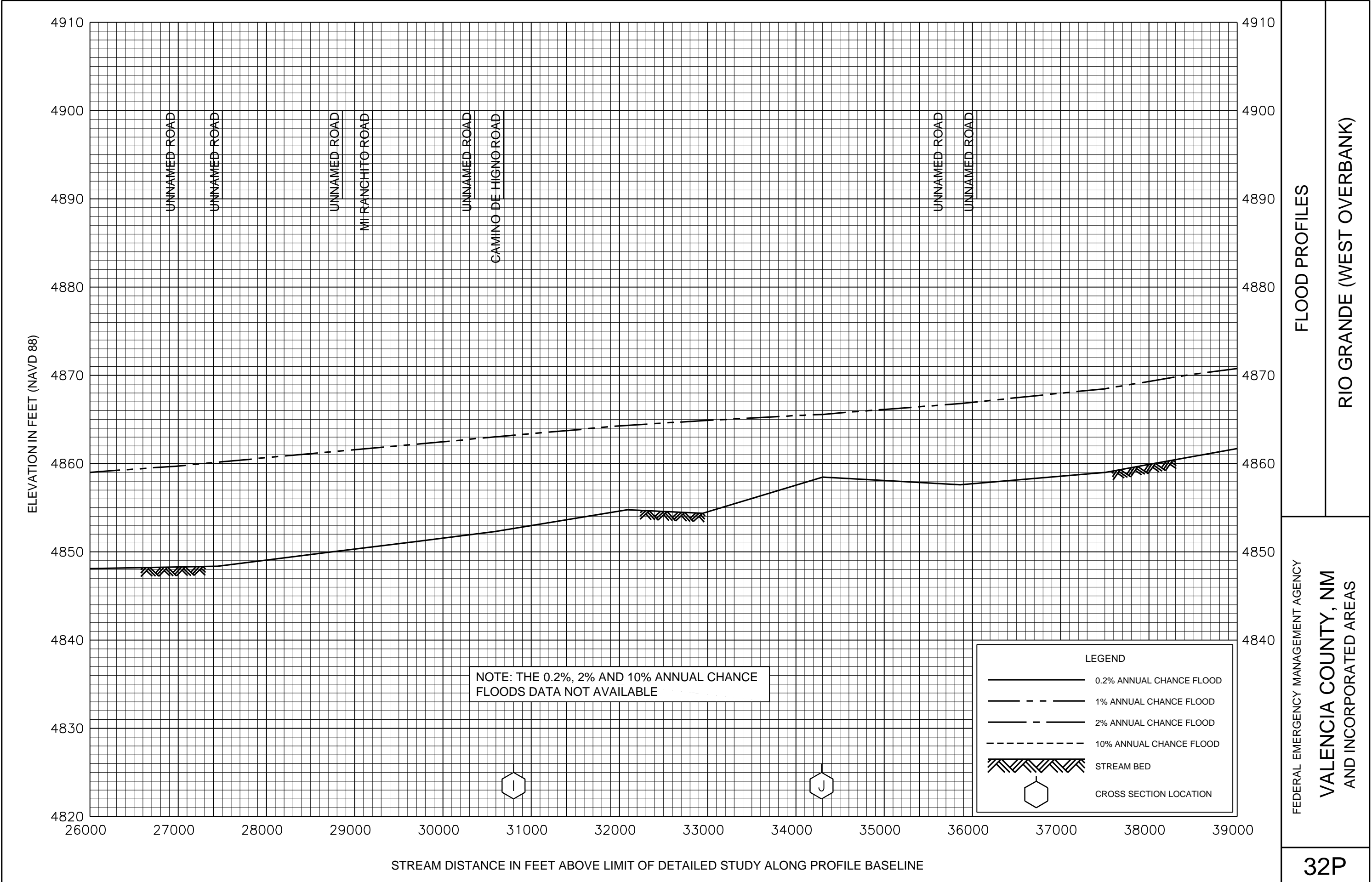


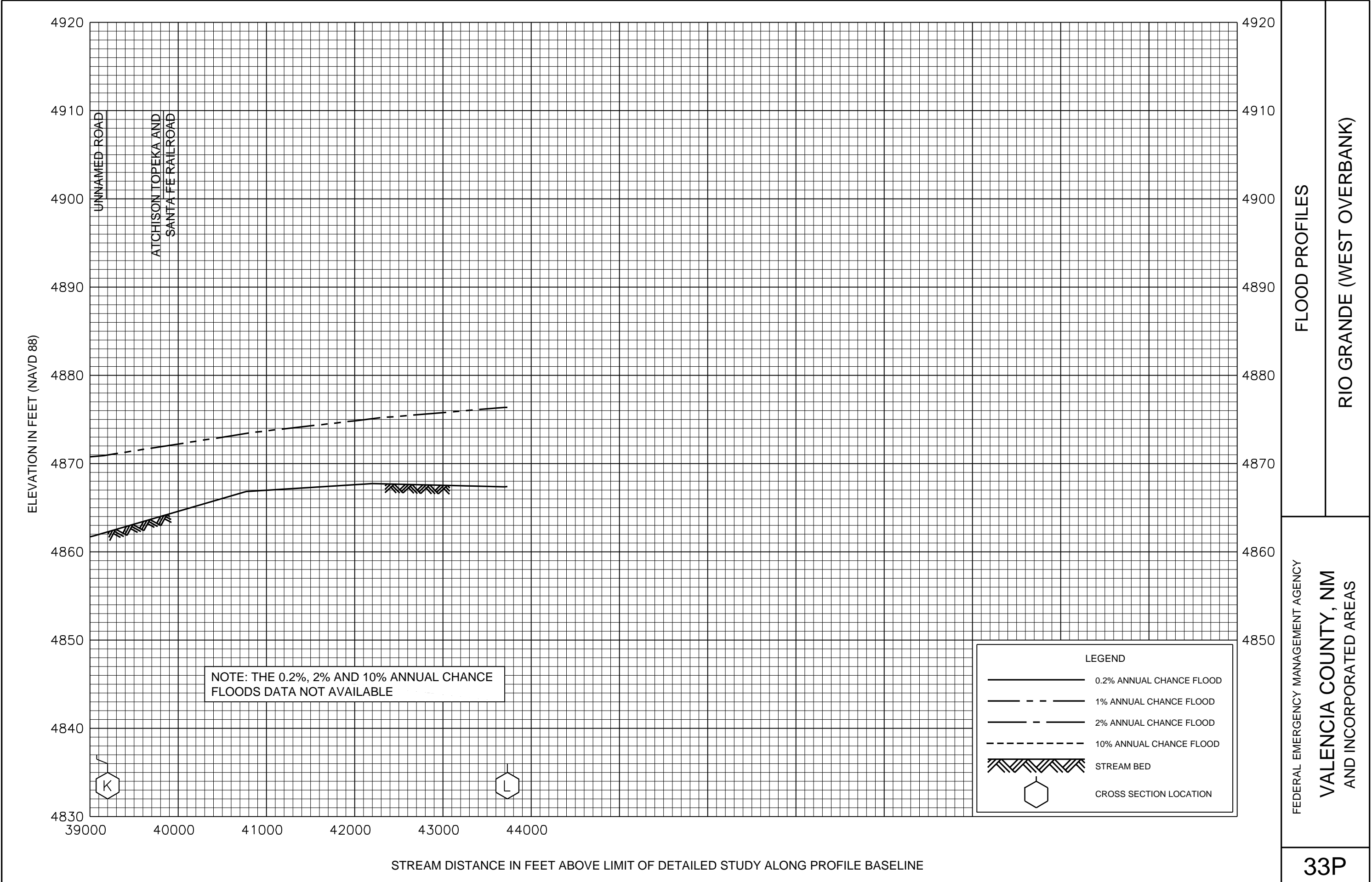


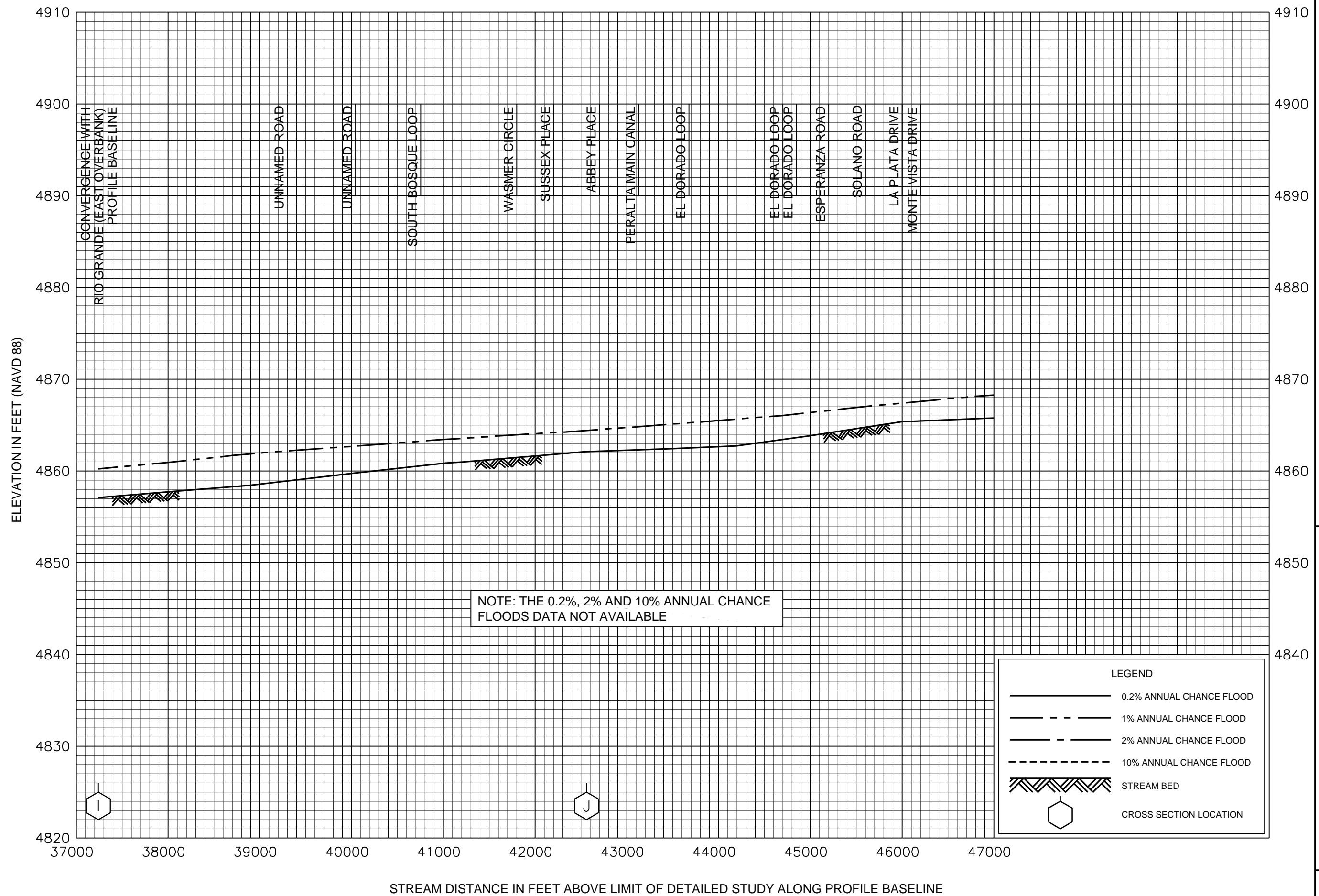












FEDERAL EMERGENCY MANAGEMENT AGENCY

VALENCIA COUNTY, NIM AND INCORPORATED AREAS

FLOOD PROFILES

RIO GRANDE (WEST SPLIT FLOW)

34P

